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Forthcoming Events.

NOVEMBER 12.

Institution of Engineering Inspection:—Ordinary meeting in London. "Further Notes on Ciment Fondu," Paper by H. J. Davey, M.B.E.

Institute of Metals (Sheffield Local Section):—Meeting at Sheffield. "Ingots and Ingot Making," Paper by H. Brearley.

NOVEMBER 13.

Staffordshire Iron and Steel Institute, Birmingham Metallurgical Society, and Institute of Metals:—Joint meeting at Dudley. "Cast Iron," Paper by Dr. Douglas H. Ingall, F.I.C.

Institute of British Foundrymen.

NOVEMBER 13.

West Riding of Yorkshire:—Ordinary meeting at Bradford. "The Technical Side of Oil Sand Cores," Paper by C. W. H. Holmes.

Scottish Branch:—Ordinary meeting at Glasgow. "Aluminium Alloys," Paper by H. Hyman.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Welsh Engineers' and Founders' Association.
Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Foundry Trades Equipment & Supplies Association.
Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

International Foundry Convention Chaos.

The establishment of the Foundry Trades Equipment and Supplies Association was forced upon that particular industry because it found itself at the mercy of any enthusiastic society or person who considered that a foundry exhibition held somewhere at some time would benefit the trade regarded in its widest sense. Now a similar, and, indeed worse, state of affairs has arisen in the matter of international foundry conventions.

The matter was mooted at a private luncheon party offered by Mr. Oliver Stubbs at Birmingham, in June, 1922. There were present representatives of America, France and Belgium, and, of course, Great Britain. Probably the general impression gained, and certainly the only practical one, was that there should be an international foundry convention held every three, four or five years. France, with commendable energy, took up the suggestion, and staged the first *official* convention the following year (1923), in the month of September. We have italicised the word "official," because at least it received the close co-operation of the principal foundry technical society in Britain, America, and Belgium, together with stray representatives from Sweden, Spain, Switzerland, Czecho-Slovakia and Italy. In 1924 and 1925, there were no real international foundry conventions, but there were congresses in Prague (Czecho-Slovakia) and Düsseldorf, which undoubtedly raised more than local interest.

This year has seen the successful staging of the second "official" international convention at Detroit, by the American Foundrymen's Association.

At a Franco-Belgian foundry congress, held last year, Monsieur Masson, the then Belgian President, announced the intention of his society of organising an international foundry convention in 1930, in Liege—the centenary year of the establishment of Belgium.

At the London convention, held last June, Monsieur España invited the attendance of the world's foundry technical societies to an international conference to be held in Barcelona in 1928.

Later in the year, at Detroit, Dr. Geilenkirchen, on behalf of the German ironfoundry associations, presented a cordial invitation for all and sundry to be officially represented at an international conference to be held in Düsseldorf in 1929.

Finally, the French Press is announcing the holding of an "Exposition Internationale de Fonderie et Congrès International" next September in Paris, to be organised by the employers federation, and undoubtedly British co-operation will be sought.

The British have so far not announced their intentions, and as the presidency of the Institute of British Foundrymen is changed annually, it is difficult to arrange for a long period ahead. Many British foundrymen, however, are anxious to have the opportunity of reciprocating to the best of their ability the hospitality they have already enjoyed in Paris and Detroit. It thus appears essential that a committee, representative of the interested parties, should meet in the near future and sketch out a programme, which will reduce international conventions to rational proportions.

As the object of these conferences is purely that of technical progress, there are, or should be, no commercial axes to grind, there should be little difficulty in making an agreement designed to serve the interests of the majority of participating nations.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Foundry Weighing Machines.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Seeing that you took exception to a paragraph in an article under the above title, in the current number of this Journal, perhaps it will be permissible for me to add something in support of your contention.

In doing so, it is not as a scientific adviser of some weighing machine concern seizing an opportunity to "poach" a space in the Journal which ought to be paid for at the usual advertising rates, but as a professional foundryman, who believes this question to be of interest to the foundry industry, because, owing to the economic situation and the ever-growing exactions of the engineers, it is becoming more and more necessary for us to have organised and scientific control over the metals with which we are dealing.

The author, who, in an otherwise excellent article, made this little "slip," has fallen into the error, not uncommon, to many contributors to this Journal, of not taking a broad enough view of the foundry industry. As this statement may appear to cast a reflection on authors of articles in the Journal, let me hasten to explain exactly what I mean.

Probably, because they have never worked in any other metals, they have drifted into thinking that the "Foundry" means the place where iron castings are made, and make statements which, although they may be perfectly true in so far as they refer to ironfounding, are often not true if applied to other branches of the foundry industry, in which many of your readers are engaged, and for which this Journal also caters.

Though, perhaps, of more importance, in some branches of the foundry industry than in others, weighing machines are an essential part of the equipment of the modern foundry. I think we are all agreed that even in melting that comparatively cheap metal, iron, it is necessary carefully to weigh the cupola charges in order to keep coke consumption, and other costs, down to the minimum compatible with rapid production of good metal; therefore, with the more expensive alloys and non-ferrous metals, the economic reasons are greater.

In steel foundry practice, in order to obtain the quality of steel demanded by the engineer, the alloys have to be "mixed" when one or all of them are in a molten condition, and to do this it is essential to have a weighing device, preferably one from which the ladle is suspended. In fact, so exacting have the engineers' demands become, not only in regard to physical tests, but also to chemical analyses, that it is only by the most careful calculations and weighing by reliable machines one is able to supply them.

Even in other foundries, by weighing the molten metal you have a check against melting costs, and, apart from the fact that by knowing the exact weight of metal in the ladle the chances of "short-runs" are reduced to a minimum, you are able to trace any loss between the weight charged and the finished casting, which, if excessive, can be reduced by tightening up the section where it arises.

Undoubtedly, weighing machines are of very great assistance in the foundry; that there is room for improvement I know, but that the makers of them will pay for any suggestion to improve them I have reason to doubt.

ETHICUS.

Sheffield.
November 1, 1926.

AT THE expiration of three months the names of the undermentioned companies will be struck off the Register of Joint Stock Companies, and the companies will be dissolved:—Cleveland Forge Company, Limited, Contact Engineering Company, Limited, Dayton Coal and Iron Company, Limited, Farringdon Foundry and Pattern Company, Limited, Gawber Colliery Company, Limited.

Institute of British Foundrymen.

LANCASHIRE BRANCH.

Congratulations to Mr. Makemson.

The Lancashire Branch held a meeting on November 6, at the Manchester College of Technology, Mr. S. G. Smith (Branch-President) in the chair. In opening the proceedings he said they could not let the opportunity slip of congratulating the Branch secretary, Mr. T. Makemson, on his appointment as General Secretary of the Institute. (Applause.) They were aware that Mr. Makemson himself did not want to say much about it, but the members felt that the appointment reflected credit on the Branch, and that they had reason to be proud of having provided the Institute with a General Secretary. (Applause.)

MR. MAKEMSON said he realised that after taking up his new post he would be unable to devote as much time to the affairs of the Lancashire Branch as he had hitherto done; he must stretch his energies over all the Branches. But his connection with the Lancashire Branch would always be an intimate one; it would have the first place in his affections. During the four years that he had been secretary—he was now in the fifth year—the members and himself had drawn closer to one another, and that alone had been a great compensation for the work he had done for the Branch. He hoped there would continue to be opportunities for joining and helping in its work.

A Paper on the "Manufacture and Properties of Blackheart Malleable Cast Iron" was read by MR. A. E. PEACE, of Derby.

Institute of Metals.

At a meeting of the London Local Section of the Institute of Metals, held at the Royal School of Mines, South Kensington, on November 4, Dr. A. G. C. Gwyer, B.Sc., Ph.D., chief metallurgist of the British Aluminium Company, Limited, Warrington, gave a lecture on "The Structure and Properties of the Aluminium-Silicon Alloys." Mr. A. H. Mundey (Chairman) presided over a large gathering of members.

Dr. Gwyer remarked that within the last few years "modified" aluminium-silicon alloys had attained considerable prominence, partly on account of their excellent mechanical properties and partly on account of their good founding qualities.

The investigation dealt with their constitution, structure and mechanical properties, and a theory based upon colloidal lines was put forward to explain the nature of the "modified" structures. It was shown that the theory is capable of general application, and examples were given of its application to other alloy systems, not only in which aluminium is the predominant metal, but in which it is absent.

The alloys possess remarkable properties. They are appreciably lighter than pure aluminium, whereas the great majority of aluminium alloys in use at the present time are heavier, and in both the chill and sand-cast states possess a much higher resistance to shock than such well-known alloys as 3L11 or 2L5. They also possess excellent ductility, but on the other hand their elastic limit and resistance to fatigue are not quite so good as that of some of the other well-known light aluminium alloys. They are, however, distinguished by a high degree of incorrodibility, particularly when exposed to marine atmospheric conditions.

The lecture was illustrated by a large number of microphotographs and curves.

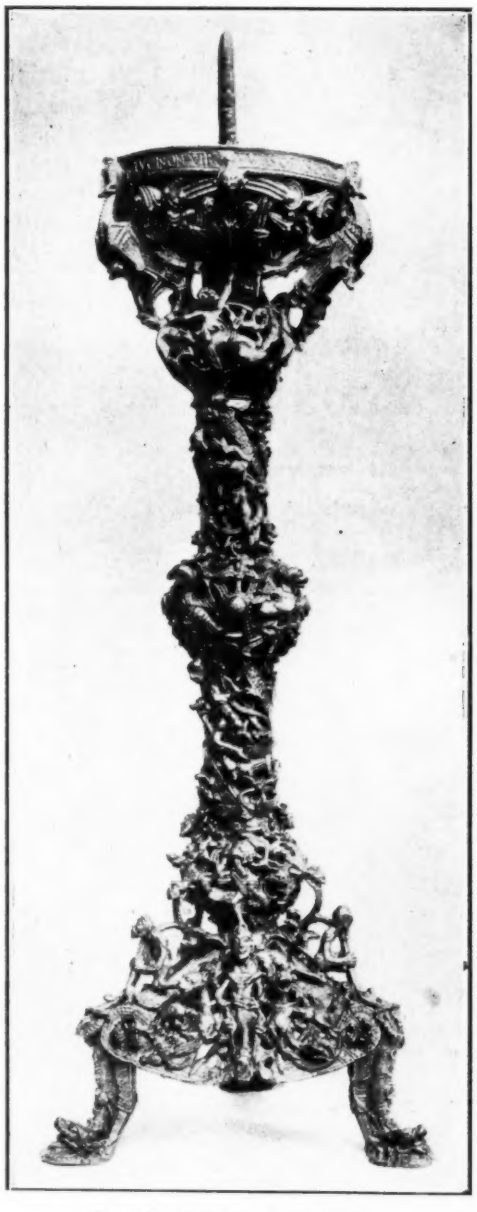
Smoke Abatement League of Great Britain.—This League has issued its seventh report, dealing among others with the following subjects:—(1) Clean-Air Weeks; (2) Clean-Air Campaigns; (3) A proposed "Clean-Air" periodical; and (4) the handbook entitled "Home Fires without Smoke," to be issued by the League and to be published by Ernest Benn, Limited (Bouverie House, Fleet Street, E.C.4).

The Gloucester Candlestick.

BY H. LITTLEHALES.

Perhaps the finest candlestick, and one of the most beautiful castings ever made, was that presented for use at the high altar of the abbey church of St. Peter, now Gloucester Cathedral, in the days of the Norman kings.

The history of this candlestick is a curious one, commencing with its making, probably at Gloucester, in the twelfth century, for a foundry was often part of the equipment of a large monastery, and Brother this or Brother that of the monastery



THE GLOUCESTER CANDLESTICK.

may have designed and also cast this magnificent piece of craftsmanship. The designing, making the alloy, and founding, would present no difficulties, for we know the procedure to have been very similar in every respect to those of the present day.

Up to the present the history of the candlestick ends with its incorporation amongst the national treasures of art in the Victoria and Albert Museum at South Kensington.

In what way this candlestick escaped destruction at the time of the religious changes is not known, but for some time afterwards it held a place of great honour in the Cathedral of Le Mans in Northern France, from which it again disappeared at the time of the French Revolution.

The candlestick stands some twenty inches high and is of base metal, to which fact it undoubtedly owes its preservation, for had it been of silver it would assuredly have found its way into the melting pot with many other like articles of church property at the time of the Reformation. The whole surface of the candlestick, which is of exceedingly solid construction, is one mass of intricate and encrusted ornament, a large part of which is of open work.

In this mass of ornament we see figures of knights, dragons, birds, griffons, strange human and animal figures, ribbed tracery, inscriptions, etc. The candlestick has no socket but is of the pricket order, and doubtless many great candles have been both set and burned upon its great spike.

The topmost rim is circular and is upheld by three grotesque birds. The amply spreading base stands on three feet, of which the main ornamentation takes the form of dragons' heads. The whole was, when in use at Gloucester, covered with silver plating, of which a considerable amount still remains. Few more exquisitely beautiful specimens of the founder's and metal craftsman's art remain to-day in existence. The authorities of the Museum describe the candlestick as of English workmanship of the period of about the year 1110.

No significance is to be attached to the fact of this being a *single* candlestick. Foundrymen and metal craftsmen in the last few centuries have almost invariably made their candlesticks in pairs, as we see them to-day on mantelpieces and church altars. But up to the time of the Reformation a single candlestick was commonly set on the right-hand side of the altar.

Many instances, however, are to be found of pairs of candlesticks, both for domestic and ecclesiastical use, of considerably earlier date than that of the Reformation.

Bell metal, gun metal, latten and brass, all of somewhat similar composition and appearance, we now call "base metals," but in medieval times "Shroff metal" was the term applied to such alloys.

For the photograph we are indebted to the kind courtesy of the director of the Museum. The photograph shows the very beautiful proportions of the work and the extremely bold projections of the main ornament, as also the delicate and fine craftsmanship exhibited in the finish. The approximate date of the work is easily arrived at, for one of the three inscriptions, that which we see interlaced and winding down the stem, tells us that the candlestick was presented to the church by Abbot Peter, who held office at the monastery from 1104 to 1113.

The two other inscriptions in addition to the important one on the stem recording the origin of the candlestick are both of them respectively inside and outside of the topmost rim. It should be added that the eyes of the figures are of glass, a fact which is more apparent in the original than in the photograph.

Foundry Statistics.

For the first nine months of this year Sweden produced 350,300 metric tons of pig-iron and direct castings as compared with 326,300 for a similar period last year. They have exported 35,343 metric tons of pig-iron as against 53,957 last year; whilst imports of pig-iron for the corresponding periods were 44,827 and 29,527 metric tons. Roughly, 11,000 tons of cast-iron pipe have also been imported.

During August Belgium and Luxembourg exported 2,566 tons of castings to Great Britain, and imported 11 tons from this country. Their total export of castings during this month was 4,660 metric tons, whilst imports reached 575 tons.

Foundry Query.

Can any reader give an analysis of a good-wearing gun-metal for bushes, sea-water lubrication only?—CONSTANT READER.

The Founding of Magnesium Alloys.

In a Paper before Royal Aeronautical Society Mr. W. R. D. Jones dealt with magnesium and its alloys, and in relation to the founding of them made the following comments:—Magnesium is chemically a very active element, especially so at elevated temperatures, and in the molten condition will combine with the majority of other substances, and is capable of dissolving large quantities of gases which come out of solution when the melt solidifies. Consequently it is by no means an easy matter to obtain sound castings in a manner which can be carried out readily in any works. The metal must be melted in a steel or iron crucible, as the use of a clay crucible causes contamination of the melt with silicon, and the use of graphite crucibles is not possible on account of carbide formation. The chief difficulties are the formation of relatively large, smooth-walled gas cavities and inclusions of slag formed by the use of flux which is necessary to prevent excessive oxide formation. The gas originates in the molten metal from three sources:—(1) By mechanical entanglement between pieces of the charge; (2) solution from the furnace atmosphere; and (3) carbide formation and its subsequent decomposition on solidification of the metal.

The author and his colleagues have carried out a great deal of experimental work on the production of sound castings, and have succeeded in being able to produce definitely sound ingots up to 4 in. dia., free from gas holes, slag inclusions, contamination of the melt with iron or silicon, and with complete freedom from burning. No "dope" of any kind has been used, and the method can be carried out in any foundry desiring to cast these ultra-light alloys. The method recommended is as follows:—A bottom-pouring forged steel crucible is "broken in" by forming on the internal surface a skin of magnesium or a magnesium rich iron alloy by melting scrap metal in it for some hours. In this way no iron from the crucible, stopper or stirrer goes into the melt.

The advantages of bottom pouring are:—(1) The melt does not pass through a layer of slag and flux on teeming, with the result that metal with few, if any, inclusions is obtained; (2) the lid can be made tightly fitting, and is not removed either during melting or teeming, thereby minimising oxidation and loss; 3 to 4 per cent. of the weight of metal melted of a mixture of anhydrous magnesium chloride and fluoride is a satisfactory flux. The flux is very deliquescent, and is best fused immediately before charging the crucible. The slag left is also deliquescent, and gives a distinct smell of ammonia and acetylene, due to the formation of nitrides and carbides during melting. After a melt is teemed, the crucible should be scraped and cleaned immediately. The melting loss must be kept as low as possible, inasmuch as with a high loss the impurities, *e.g.*, iron and silicon, are concentrated in the metal. The melting loss can be kept to a minimum by using sufficient, but not too much, flux, and by the avoidance of over-heating or soaking the metal. With satisfactory melting practice the loss should not exceed 0.5 to 0.75 per cent.

The colour of the ingot or casting is yellowish instead of white if the temperature has been too high or prolonged soaking has taken place. The crucible, stopper, stirrer and lid are made red hot and thoroughly cleaned and charged while black hot, so that no moisture is present. Any trace of moisture in the metal, flux or crucible will result in unsound castings. The alloying elements may be added as previously-cast, rich alloys or hardeners. The hardener is added near the centre of the charge, and the flux distributed at regular intervals. When the crucible is charged the lid is put on tightly.

The melting operation can be conveniently carried out in an upright circular gas furnace. When melting is complete, as judged by the sinking of the stirrer to the bottom of the crucible, the metal is thoroughly stirred to incorporate the flux in the molten metal. The gas supply is turned off and the crucible allowed to cool reasonably slowly. When freezing is complete the gas supply is turned on again and the metal re-melted as rapidly as possible. Stirring is not again resorted to in order that the metal shall not be contaminated with flux and slag. The gas supply is lowered and the pot allowed to remain at rest for a few minutes. The pot is then taken from the furnace and teemed into the mould placed an inch or so below.

For chill-castings, the moulds of forged steel or cast iron should have a smooth polished finish, showing no tool marks, as it was found that a number of failures which occurred during machining and a number of irregular test results were traced to small internal cracks in the bars which appeared to have been developed by stresses set up by solidification owing to the metal being gripped by rough tool marks. A slight taper on moulds larger than about 1¼ in. dia. was found to be beneficial.

Moulds are preheated to a temperature higher than that generally used, and a proved temperature is between 350 deg. and 400 deg. C. Using lower temperatures, there is a great risk of cold-shut. No mould dressing is necessary. Moulds of about 1 in. and less in diameter are best poured when inclined about 45 deg.; larger diameter moulds can be teemed in an upright position. The melt should always be teemed slowly on the tip of the mould near the top, and should be somewhat on the sluggish side. There should be no interruption of the continuity of the metal stream, or cold-shutting will occur. For sand castings a hard-baked mould should be used and the core oven run at a higher temperature than usual, *i.e.*, about 400 deg. C. The sand should have a high percentage of silica, and so be low in materials likely to loose combined water at about 700 deg. C.

The moulds and cores should not be removed from the ovens until immediately before teeming. If they happen to have cooled down, then they must be put back into the oven, in case the sand should have re-absorbed moisture during cooling. If permanent moulds can be used, then they will in all probability prove eminently satisfactory for these alloys.

Gates should be as small as possible consistent with a free flow of the metal. These alloys necessarily require a larger head of metal than other alloys to produce the same pressure, and the length of the runner should be at least half as much again as that used in aluminium alloy castings. Castings can easily be obtained with an excellent silvery skin, and there is no tendency for sand to stick to the surface. The surface can be cleaned from sand or white oxide by wire brushing. Castings can be given a beautiful finish by a momentary dip in strong nitric acid or dilute hydrochloric acid and immediately rinsing in running water. This practice is not recommended for general use.

The forging of alloys containing from 85 to 90 per cent. magnesium is easily performed by rolling, extruding, drawing and hammering and drop forging, with a general improvement in the mechanical properties. The best general forging temperatures are from 410 deg. C. to 450 deg. C. Above this temperature there is the liability to burn, and below 400 deg. C. there is a strong tendency to cold shortness. The billets should be heated and soaked at the temperature in a gas furnace free from the possibility of flames impinging on the bars and under pyrometric control. The best practice the author considers is to use a muffle furnace heated to a constant temperature of 420 deg. C. ± 5 deg., then to place the billets inside, and after the temperature has again reached 420 deg. C., to allow the bars to soak for one hour.

The specific heat of magnesium being relatively high, the time taken for the bars to reach the forging temperature is greater than usual. For forging down under the steam hammer the tools should all be at about 400 deg. C. Pure magnesium and alloys containing up to 2 per cent. alloying element can generally be forged from 2½ in. diameter down to 1 in. without reheating. The greater the amount of alloying element, the harder the alloy and more reheatings required. A little experience will soon enable the worker more easily to gauge when the alloy is too cold and requires reheating. Magnesium alloys, if forged within the correct limits of temperature, will withstand "brutal" treatment. Sound forged bars will emit a pleasing ring, which can be used as a rough guide for their soundness.

The International Foundrymen's Convention at Detroit.

The Tour of Overseas Foundrymen under the Auspices of the American Foundrymen's Association.

(Continued from our previous issue.)

BY OUR SPECIAL CORRESPONDENT.

Philadelphia, "the City of Brotherly Love," maintained its traditions by the glad hand of welcome it offered to the warm and weary pilgrims on their arrival at melting noon on Wednesday, September 22.

The Philadelphia Foundrymen's Association were worthily represented by their Entertainment Committee, of which Mr. Stanley G. Flagg was General Chairman, whilst Mr. G. H. Clamer was Chairman of the Reception Committee, and Mr. B. H. Johnson, Chairman of the Information Department. Mr. Frederick M. Devlin was in charge of the banquet, and Mr. Hopkins looked after the finance, ably supported by Mr. H. N. Giles, who had in his care the plant visitation and motor service, whilst the envied position of Chairman of the Ladies' Entertainment Committee was occupied by Mr. W. L. Kalbach.

The City of Philadelphia.

The name of the city of Philadelphia is to most Britons just a name, a name they rather like because it ripples readily from the tongue, but a name and nothing more. Those who took part in this pilgrimage are now wiser, and realise exactly what and how much Philadelphia means to the United States.

The Mayor of Philadelphia, Mr. W. Freeland Kendrick, is a fine man. He knows his city and its motto. He knows it is a superior and a self-respecting city, a city with more than a touch of aristocratic feeling, and a city for which the best is only just good enough. His welcome to the delegates by means of a handy booklet entitled "Little Glimpses of Philadelphia, in its Past and Present Aspects," was couched in the following words:—

"A Welcome to Philadelphia."

"Cities differ from one another just as people do. Much of the character of Philadelphia to-day is traceable to that of its great founder. William Penn was a man of high ideals, a lover of liberty and justice, a firm believer in the rights of all men, and in the good of all the people. When he founded Pennsylvania, Penn set out to establish a colony different from any in the world, assured, as he said, that 'My God will make it the seed of a new nation.'

"Philadelphia's first settlers were artisans rather than adventurers; whilst Liberty was their watchword, Industry was their reliance. Here on this firm foundation for more than two centuries have wrought an industrial host who have produced things of use for themselves, for their countrymen, and for mankind, making and keeping this community a workshop of the world.

"Philadelphia is a patriotic place. It was for years our metropolis and capital, and has furnished and sheltered many builders of the nation. From the day when the old Liberty Bell proclaimed 'Liberty throughout the land and to all the inhabitants thereof' Philadelphia's men in large numbers have responded to our country's calls for help.

"Philadelphia is busy making a great community greater, and with the utmost goodwill she salutes you.

"Philadelphia the city of homes, and the home of busy, patriotic folk, extends friendly welcome to folk from every place, glad to have them sojourn or abide under the broad and sheltering hat of William Penn."

The reference is, of course, to the broad-brimmed Quaker hat of William Penn.

The Liberty Bell.

The Liberty Bell was ordered from England by the Assembly of Pennsylvania in the year 1752. Strangely prophetic was the quotation specified to be cast upon the upper rim of the bell, "Proclaim Liberty throughout all the land and to all the inhabitants thereof." After its arrival in America and during its first testing the bell cracked. It was repaired by local labour and remained in constant service until 1835, when it cracked again and has remained cracked ever since.

The bell was, of course, ordered and delivered before the American Declaration of Independence, and its hold upon the heart of the Americans is that after the formal signing of the Document embodying the Declaration it was used as a signal to "ring out the old and ring in the new" era.

Many thick books have been written about and around Philadelphia. The subject is a fascinating one, but we must resist the temptation to dwell upon it. Suffice it to say that so far as the observations of the delegates may be relied upon, its inhabitants of to-day, or, at any rate, those with whom we came into contact, do their utmost nobly to maintain its ideals of mutual helpfulness, and it is perhaps to this spirit that it owes much of its greatness.

A Pleasant Place to Live in.

It would probably be a pleasant place to live in. The streets are not so broad as those of New York, and the buildings seem taller in comparison. It seems more like an English town, and whilst we were there it was very, very crowded with all sorts and description of men and women. At the station were observed many men in strange garb. Some were like pierrots, some like pirates, some in white baggy trousers wore red fezes, and in the streets were met men of full habit who wore blue uniforms like those of naval officers, chains and belts around their necks and waists, and heavy, business-like looking swords. Upon their heads were hats such as the one Napoleon wore, but with the difference that these hats were crowned with ostrich feathers, with the pen in the front and the plume at the back. Some feathers were red, some blue, some white, some pink, and some hats and uniforms, too, were much more magnificent than others. We regarded these individuals with great awe, your scribe opining that they were possibly veterans of some not too recent war. Whilst he had accepted the explanation that the different humorously attired groups standing around the station were the members of various clubs and societies come to visit the great Sesqui-Centennial Exhibition or to witness the "Great Fight" between Dempsey and Tunney, the gentlemen with the feathers were a mystery until arrival at the magnificent Benjamin Franklin Hotel, where accommodation for the party had been arranged.

A Full House.

Here it appeared that, not being full enough with people come to see the Exhibition, with "fight fans," and with our party of 100 people, they were also entertaining what were understood to be members of the Independent Order of Odd-fellows of Ohio. It appears that in the States the members of such benevolent societies distinguish themselves from the rest of mankind by a uniform worn when they are about the business of their societies, and afterwards we saw many such dress parades, and observed with admiration, not unmixed with envy, the utter lack of self-consciousness of the average American citizen, and got the idea that though he probably does not like to "dress up" any more than our young people here, he does not make any pretence that he is ashamed to be seen out in his regalia.

What a hot day it was, to be sure, and how welcome was the "near-beer" from the hotel drug store, though it did cost 1s. 8d. for a smallish

bottle, which reminds me that most of the large hotels contain around the covered courtyard or central hall a few shops from which the visitor may purchase fruit, drugs, tobacco, sweets, stationery and similar trifles without the necessity of going outside.

The Coloured Folk.

It was in this city that we first began to notice the negroes, who seemed to be commoner here than in New York.

These "coloured folk," as they must be described to themselves if offence is not to be caused, were objects of interest to the party until their novelty wore off, and it was soon observed that they varied considerably, the one from the other. Some were shiny black like plumbago; others were brown as berries, some chocolate coloured, and many of varying shades of pale brown and buff of a by no means unattractive tint. Many, if not most, of the men are tall and of fine physique, with splendid chests and muscles. In many places they work side by side with the white man, but generally speaking they are the hewers of wood and drawers of water, performing such menial tasks as window and boot cleaning, the sweeping of the streets and the collection of refuse—necesary work but looked at somewhat askance by the white man, who prefers something which needs more brain for its execution.

Speaking generally, they seem throughout the States to be quiet, decent, orderly, law-abiding people, doing essential work often of an unpleasant nature for lower rates of pay than those for which the whites would work, and though we were often told they cannot "carry corn" and must be kept in their place, they do not seem to present a problem except in the South and in districts where they form a majority of the population.

The Sesqui-Centennial Exposition.

It was a great man who said the proper study of mankind was man, and much could be written about the different races which make up what we are apt, but incorrectly, to term the "American nation," but luncheon waited, they said. Thus rejuvenated, a stronger and happier delegation took their seats for the Sesqui-Centennial Exposition, to which transport by motor-omnibus was thoughtfully provided by the local Reception Committee, and for which each delegate was very kindly provided with a ticket of admission.

For the benefit of those who knew no more than did the writer before he became informed on these matters, "Sesqui-Centennial" means the one hundred and fiftieth anniversary, and it seems (though few of us were aware of it) that it is one hundred and fifty years since the Declaration of Independence was signed at Philadelphia, and that in commemoration of that epoch-making event, there has been arranged at Philadelphia a huge exhibition in a park specially laid out for the purpose. It is sad to relate that even in the U.S.A. such ventures are but seldom financially successful and that this Exhibition is no exception.

Indirectly and educationally it has certainly been of great benefit, and the visiting foundrymen found in it much to interest them. Though almost stunned by the succession of new impressions at every turn, they saw sufficient to realise that in his Government the American in industry has a scientific ally much more powerful than any possessed by the Briton.

Governmental Research.

Every department of human activity seems to be taken care of by some Board or Commission or Research Department. These organisations, with resources beyond the reach of manufacturers, and with unlimited powers in certain directions, investigate thoroughly the ins and outs of the industry from beginning to finish, and present to those engaged in it, entirely free of charge, the results of their researches. How infinitely preferable is this system to the feeble one in vogue here, where an already overburdened industry is badgered for subscriptions to make up a certain sum per annum on the promise of the provision by the Government of a lump sum. Different trades have their different ways of disposing of this fund, but instead of the provision of Government laboratories adequately equipped, in which scientists can concentrate on their researches, our own custom is to allocate the money amongst a number of different educational or scientific institutions with the result that we are seldom presented with a cogent result which can ever be regarded as exhaustive research or suitable for ready assimilation by the non-scientific manufacturer.

Model Buildings.

At this Exhibition the State department which deals with housing had a most interesting exhibit wherein were shown models of various types of houses, complete with garage, gardens, flower beds, and the pigeon set on the chimney. Alongside were offered a complete specification of all the materials required to build such a house, these forming part of a booklet giving plans, elevation, sizes and an average estimate of the cost erected complete. Be it noted that this is not the work of some contracting firm wishful to build such houses for the public, nor of the makers of certain building materials. It is done by the Government for the benefit of the people and its results are handed free to whatever citizen desires to avail himself of them. In a land where so large a proportion of the inhabitants own their own houses such a service is exceedingly valuable.

Locomotives and Automobiles.

There was a fine exhibit of locomotive work by Baldwins, and nowhere were the huge dimensions and rough finish of the American loco more noticeable than in the comparatively confined space of an exhibition building. There were many motor cars, shiny in finish and silky in action at prices startlingly below those charged in Great Britain either for American or British models. There was a little six-cylinder Chrysler and a new small four-cylinder Overland which would appeal to users of our own 10/12 h.p. light cars, but there was a noticeable difference in value and completeness at the price and in the amount of careful thought expended in offering the buyer a beautiful machine calculated to take him about the roads in cleanliness and comfort.

It is your scribe's firm and ineradicable conviction that no British maker of motor-cars can even pretend to know his business until he has made a careful inspection of American motor-car factories, where he has much to learn.

One Reason Why.

Enough said, this is not a motorists' journal, but it is very plain that though one reason why the Americans can and do give better value for the money than the British is that the American output possibilities are greater; the other, and much more important one, is that they use more brains about their job, and are not so easily satisfied.

What with the heat and the drought, life at the Exhibition for our unacclimatised party was too hard to be worth the living and they sought shady nooks wherein to imbibe tea or consume "soft drinks." Part of a huge hall was filled with wireless wonders, for "The Radio" as it is always called, is an important factor in American life.

The Radio.

There is no national broadcasting company with a Government monopoly as in our country, and anybody is, or at any rate, was, at liberty to broadcast, at his own sweet will. This means that receiving sets must be much more selective than here, and the huge demand from the multitude of families living out in the wilds, and to whom the "Radio" is a God-send, has caused the production of many types of beautiful instruments of high efficiency, at prices which seem to us to be exceedingly low; this despite the fact that anything which is in America the same price as a similar article here is cheap because of the fact that the income of the American is two or three times that of a man in a similar position in Great Britain.

In this chamber was a horn-type loud-speaker, hanging overhead and which seemed to be about 25 ft. in length and to have a mouth opening of something like 8 ft. At the moment of our call this was reproducing the singing of a celebrated American tenor, and the fidelity with which his tones were transmitted was a remarkable achievement.

The Great Stadium.

Though the party were, for the most part, assiduous to the point of exhaustion in their investigations of local products and industrial conditions, and of all matters pertaining to foundries or the products thereof and like bloodhounds in their indefatigable pursuit of knowledge and their determination that nothing short of actual physical collapse should prevent them from utilising every available moment of their stay in the States, they dragged themselves away from the exposition to prepare for the banquet in the evening. Under a giant replica of the cracked Liberty Bell, past the big coloured umbrellas fixed in the middles of the wide road junctions, each sheltering a diminutive-looking traffic director, in sight of the mammoth stadium preparing for the great fight at 9 p.m. next night, they returned to their rooms.

The way back to the hotel was through the narrow streets of the old town. The pace of the taxi driver is hot and the paving is often both rough and uneven. The shops passed were a striking example of the cosmopolitan character of American cities, for almost every one was occupied by a person of some yellow- or dark-skinned race.

Streets and Shops.

On the pavement crawled merry-looking black babies, their fat mothers gossiping on the doorstep, or leaning against the door post. Coloured folk filled the pavement and half the shop space seemed to be taken up by that great national dainty of the whole American nation, the chicken, in various stages of his career. In this part of the world, at any rate, the fowl is sold by the pound in accordance with his estimated qualifications, and over the pens wherein the large fowls mope, are placards indicating that the price is 22, 24 or 25 cents per lb. and that the inmate will be killed and dressed for 5 cents. The streets were a solid mass of people, trams and vehicles, but at length the cooler gloom of the hotel was reached, and wise men, and all the ladies retired to prepare for the evening.

The Philadelphia Banquet.

To this feast, at the palatial Manufacturers' Club, were bidden the Delegates by the Philadelphia Foundrymen's Association, and right nobly did they mantain the city's hospitable tradition and their own reputation for organisation. We tried to thank them severally and individually at the time, but as a corporate mass they were not addressed in appreciation of the night they gave us, and to everyone who contributed towards its success—for it undoubtedly was a great success—sincere thanks are now tendered.

When Philadelphia starts in to do any kind of a job it starts in to do it right, and it started right here by putting every lady of the party in a good humour by addressing to her room a dainty bouquet with a tender message. There were about two hundred people present at this banquet, and the arrangements are worthy of note and reproduction overseas. In an ante-room, where according to American custom, the diners meet for 20 minutes or half an hour's chat before dinner, and where an informal reception was held, each guest was handed a seating list, on which was printed an alphabetical list of the names of all those invited and the number of the table to which they were allocated.

The Table Arrangements.

The same sheet bore another list giving the numbers of the tables and the names of the guests who would occupy each of them. Mr. Snowball—for instance—therefore, had no more to do but to run his eye down to S and learn immediately the number of the table to which he was to proceed. Looking now to the table list and finding that he was designed to be seated at table No. 13, he immediately observes that the other seats will be occupied by Mr. and Mrs. Wells, Mrs. Winterton, Mr. and Mrs. Johnson and so on—a simple method, which results in an absence of confusion and indecision. There were round tables numbered one to twenty-one not including the long side table at which were seated, the Toastmaster, Mr. Stanley G. Flagg (be it noted that the Chairman is known in the United States as the Toastmaster) and Mr. Walter Wood, the President of the Philadelphian Foundrymen's Association (who, with Mr. Clamer, had acted as escort to the party from New York to Philadelphia). There was no less a person than

The Mayor of Philadelphia.

(Mr. Freeland Kendrick) with Mr. Charles Lyon Chandler (a prominent banker) and the dearest old gentleman in the world, Dr. E. J. Cattell, one of nature's orators, described simply as a "Philadelphian!" Invited to share this table with their hosts were representatives of each nationality in the Delegation, and amongst those from the British party who were honoured in this way were Mr. John Cameron and Mr. S. H. Russell.

Entering a lofty and beautiful room draped with the flags of all nations who were represented, the guest was greeted by a picturesque orchestra on an elevated stage. This band was clothed in Magyar gipsy costume and discoursed throughout the meal international airs played with delicacy and chosen with commendable good taste. The music was neither obtrusive nor insistent, and served rather to harmonise and accompany conversation than to force its attention upon its hearers.

Wonderful flowers of a kind that do not bloom in our less generous climate decorated each table and were divided amongst the ladies at the close of the evening (another pleasing custom). It was very, very hot, but everything possible had been done to minimise inconvenience. All round the room were electric fans and we would draw the attention of British producers and users of electric fans to the fact that all American fans are perfectly silent in action.

Before each fan were three American flags straining in the breeze—a pretty idea thought we; and we were glad to see our Mr. Cameron occupying the place of honour alongside the Toastmaster and the Mayor.

The Programme.

The programme card itself was a magnificent production which was obviously the result of careful thought. In a plate-sunk central space was a relief-stamped golden reproduction of the Liberty Bell, crack and inscription included, and on either side were flags fully coloured and acurate to the last detail.

There was a list of those who would speak and of the officers, directors, and members of the committee who had arranged the banquet, and, of course, there was the menu, which was sufficiently un-English to be worthy of reproduction here.

Supreme of Cantaloupe.
Strained Gumbo, en Tasse.
Celery. Salted Nuts. Olives.
Whole Squab Chicken, Boned.
Potato, Rissolee.
Braised Hearts of Celery au Jus.
Tomato, Suedoise.
Meringue Glace. Assorted Cakes.
Demi-Tasse.

The Menu.

Starting with a long deep pull of iced water, the American national beverage, and the only drink obtainable on this or other public occasions, the guest found that the first item was a large slice of melon, and the next was a clear soup in a cup. He noted that in England the olive would have appeared first and the celery last and proceeded to the Whole Squab Chicken "Boned," which was a well-grown baby chicken cut off in the flower of his tender youth, and doomed never to crow a note or lay an egg. Nevertheless, he did not die in vain, and it is more than doubtful if he could ever have given as much satisfaction in his life as he did in his death. The food, though a little unfamiliar in description, presented to the palate no such novelty as to cause any of the guests to fight shy of it, and it was generally conceded that both the Association and the Chef were to be complimented.

Mr. Stanley G. Flagg, Jun.

The repast past, MR. STANLEY G. FLAGG, JUNR., arose, a dignified figure, and offered a warm welcome to those who had come so far to see the New World, saying he was convinced that these international exchanges of visits and information are for the benefit of all parties, and knew his countrymen would receive as well as give. He knew that the high wages general in the United

States, and the low production costs have been a puzzle to many, and we should find the explanation to lie by no means entirely in the greater use of machinery or the greater output possibilities, but, to a marked degree, in the strong *esprit de corps* which possesses the workers in American factories and the great willingness on the part of the employer to reward merit and effort. He reminded his hearers of the phenomenal industrial growth of the United States, and that though it possesses only 7 per cent. of the population of the world it produces 22 per cent. of its wheat, 58 per cent. of its steel, 72 per cent. of its oil, and 43 per cent. of its coal. It has 4,044 cast-iron foundries, 3,316 non-ferrous foundries, 357 steel foundries, 182 electric steel producers, and 214 malleable iron foundries. He hoped these figures would be of interest, and offered the warmest possible welcome to the delegates.

Mr. Walter Wood.

Mr. Walter Wood said, with a merry twinkle in his left eye, that he would be unable to make his speech. He could not speak without notes, and Mr. Flagg had been at his coat tail pockets and taken his notes, and said what he himself had intended saying. The Philadelphia Foundrymen's Association, he said, was the very first to be established in America for mutual helpfulness and the spread of information. The other foundrymen's Associations grew from it, until there were so many of them that they became unified as constituents of the American Foundrymen's Association. The A.F.A. was thus a child of Philadelphia, where the American Constitution was also born, and he pointed out that that was a system of government so successful that it had been copied in all parts of the civilised world. He was real glad to see them all there, and would leave to others to say more eloquently the very great deal more that was to be said.

The Hon. W. Freeland Kendrick.

The Mayor of Philadelphia said he was honoured by the opportunity to speak to them that night, and to offer to the important international gathering a welcome from this important city and State of America. Americans, he said, wanted to be better understood. The interests of all of us were so bound up together that it could only be in the best interests of all of us that we should have such opportunities of meeting together. He spoke highly of Mr. Flagg as one of Philadelphia's prominent citizens. who was always willing to maintain the high tradition of brotherly love for which Philadelphia stands. He (the Mayor) spoke for a city whose population is over 2,000,000, and he hoped all would be impressed with the genuine hospitality of its citizens, who had offered and would offer of their best to the Delegation from Overseas.

Mr. Charles Lyon Chandler.

Mr. Charles Lyon Chandler said, in a charming address, that Samuel Butler had written:

"Ah, me, what perils do compass
The man that meddles with cold iron."

But what of he who handles hot iron, and that every day of his life? Pennsylvania was used to hot iron, and was at home with foundrymen, because it was, more than any other State, built up on the growth of the iron and steel industries.

Mr. Chandler astounded those of the gathering who were not in the know, by making his speech of welcome consecutively in English, French, German and Spanish, an example of erudition on the part of a banker which met with a very hearty reception indeed.

Dr. Edward J. Cattell.

Dr. Cattell (a decidedly elderly gentleman) said he was a bachelor with hopes—(laughter)—and he specially welcomed the ladies, to whom he had given his heart, though he was not born yesterday. The city, said he, was 240 years old, and it had been said that he and it were twins. Philadelphia to-day was making more progress than ever before in its history, but he did not know that he could quite say the same of himself. (Laughter.) Dr. Cattell's speech was filled with wit and wisdom, and a number of his epigrams are worth memorising. "You never see your own shadow," he said, "until you turn your back on the light. We love life and we do not really believe that we ourselves can ever grow old." "If we can't get what we like, we must like what we can get." He believes in believing the other man's stories and then, if we exaggerate, he believes ours. It is the spirit that counts. One day he had picked up in the streets a little fellow who had slipped down awkwardly and broken his leg. "Hurt?" said he. "No," said the boy, "I was going down anyway!"

The great majority of people want to be good but don't know how. They want showing. These great international gatherings are teaching us that what is bad for one is bad for all. On a visit to Scotland he had read on a tombstone, "I was well, I wanted to be better—Here I am!"

As evidence of the growth of Philadelphia, he said the city was building three new homes every day, and every 20 minutes a new baby was born to brighten them up. In Philadelphia 900 church spires pointed the way to heaven, and there were no less than 3,800 organisations devoted to the alleviation of suffering and the betterment of life.

The widening area of spending power has put a new vitality into commerce, and an example of its operation was that of the Steel Trust, which, for ethical considerations, shortened the hours of labour. This gave its employees time to use their automobiles, and thus, in its turn, increased the demand for automobiles, which in its turn called for more of the steel company's products!

The Lord made man first and woman after, but man has been after woman ever since. If there are no women in heaven he is going to ask for a transfer south. He thanked the party for coming to see them in their old city of Philadelphia. He wished them a safe and happy journey, and an early return to Philadelphia the city of William Penn.

The End of a Happy Day.

And on this note ended a very happy evening. It was noted that it is the American habit to make it perfectly clear that the proceedings have terminated by an announcement from the Toastmaster, who generally says: "Ladies and Gentlemen, the meeting is adjourned." It is apparently easier there to be eloquent on ice, than here to be incoherent on alcohol. At any rate, the American banquet has no aftermath, and the morning after the night before is an experience unknown after a public banquet.

A Model Brewery.

An incident which befell one of the British party in Philadelphia is worth recording. This particular member had a "hunch" for going off on his own, and was visiting a foundry solo in quest of certain information, and whilst there two unfortunate nigger labourers incurred the wrath of the police by loading spent sand and other foundry refuse into a cart without first having damped it down according to law, thereby causing much dust to rise. The two unfortunates were duly arrested, and the police official entered the manager's office to inform him of the event and serve the necessary papers on the firm. In the temporary absence of the manager our member, by way of a joke, accepted the papers, and started to question the official on the matter, but immediately he spoke the man realised he was talking to an Englishman, dropped his official manner and insisted on talking about "Good old London," the place where he lived twenty years ago. So friendly did the two become that the offending niggers were let off with a caution at our member's request, and he was invited to the officer's house to inspect his central heating plant. To cut a long story short, this central heating plant turned out to be nothing more nor less than a complete model brewery and distillery, and great was the envy of other members of the party when they heard later of the three glorious bottles of nut brown iced ale enjoyed by the "insular" one that very hot afternoon.

(*To be continued.*)

Publication Received.

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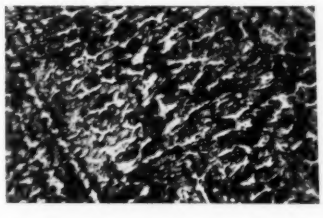
The foundry interest is fully maintained in this issue. A new serial article on Engineering Materials—Testing and Properties should command the close attention of all foundrymen.

On the Malleable Cast Iron and the Mechanism of its Graphitisation.*

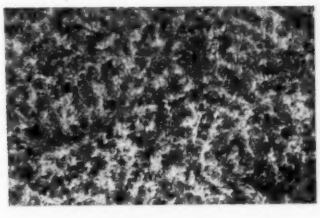
By Tario Kikuta (Research Laboratory, Tobato Foundry Company, Tobato, Japan).

Introduction.

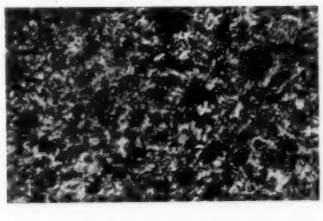
In 1722 a French physicist, Réaumur, obtained a white heart malleable cast iron by heating white cast iron surrounded by pulverised hematite powder at a high temperature for a long period of time. Later, in 1826, Seth Boyden, by using pig-iron of a lower sulphur content containing a high percentage of manganese, instead of the high sulphur, a low-manganese material which had usually been employed up to and at his time, obtained a black heart malleable cast iron, which is now generally recognised as superior to the former in malleability. Though the art of making malleable cast iron has developed a great deal since Réaumur's time, there has hardly been any theoretical work done on this subject, until quite recently, many investigations in this kind of casting having been made and the results published. They have, however, been either fragmentary or almost always confined to some special cases of the problem. In the course of the present investigation of the graphitisation of white cast iron, some important data have been published by Mr. H. Sawamura,† Assistant Professor of the Kyôto Imperial University, who has also been engaged in the study of the same subject. He used a dilatometer, but the specimen, the dilatation of which was measured by him, was cast in an iron mould 5 mm. in thickness, the temperature being raised at a constant rate, so that his results do not furnish us with any direct information regarding practical annealing in a cast-iron foundry. A few years ago, the writer made a dilatometric study of the growth of grey cast iron which occurs during repeated heating and cooling, and it was observed that the graphitisation of cementite in white cast iron is distinctly proved to occur by the expansion accompanying such a reaction. The principal object of annealing a white iron is the graphitisation of the cementite in it by virtue of which the conversion of a hard and brittle material to a soft and malleable one is effected. By using a dilatometer, measurements have been made of the amount of the graphitisation, which took place on keeping the test specimen at a constant high temperature, as is done in practice when annealing white cast iron in the foundry, and the progressive degree of this reaction was checked microscopically afterwards. By using these methods, the writer has attempted to work out the theory of graphitisation of white cast iron, as well as to study the effects of annealing temperature, thickness of casting and the chemical composition of the material, etc., upon the graphitisation.



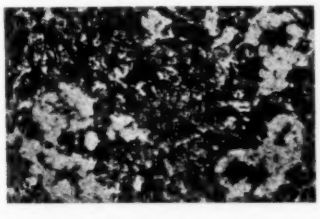
Micro No. 1, Sample No. 1. White Cast Iron X 100.



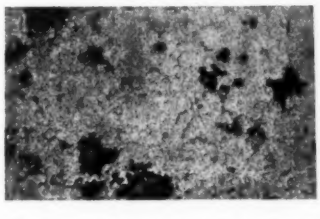
Micro No. 2, Sample No. 2. Corresponding to Fig. 1 X 100.



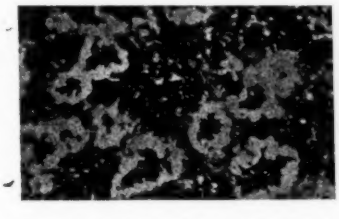
Micro No. 3, Sample No. 1. Corresponding to Fig. 2 X 100.



Micro No. 4, Sample No. 1. Corresponding to Fig. 3 X 100.



Micro No. 5, Sample No. 1. Corresponding to Fig. 4 X 100.



Micro No. 6, Sample No. 2. Corresponding to Fig. X 100.

Graphitisation of White Cast Iron into Malleable Cast Iron.

The methods adopted by previous workers in investigating the processes of the annealing of malleable cast iron consisted in carrying out the microscopic research and the chemical analysis after subjecting the iron to various kinds of heat treatment. The drawback of these inherent methods is that there is great difficulty in getting exact information as to the changes taking place at the various stages. In the present investigation, however, a dilatometer was used and the dilatational changes, which have been shown to be

* Extracted from the Science Reports of the Tohoku Imperial University, Sendai, Japan.

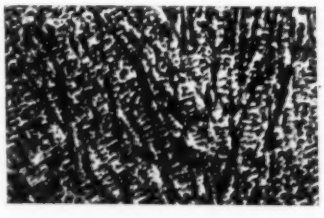
† The Suiyokwaishi published by the Kyôto Imperial University; Vol. 4 (1924). Nos. 5-8.

proportional to the amount of graphitisation, were measured at various time intervals, the specimen being kept at a constant high temperature. Parallel to these dilatational measurements, microscopic examinations have been made to determine the progressive degrees of graphitisation.

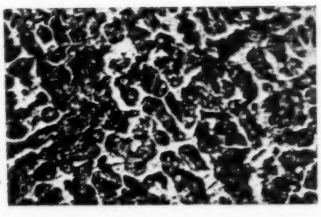
The specimens used in the present investigation were made by casting the molten metal in a sand mould, the metal being taken from an air furnace, to form cylindrical rods about 20 cm. long and 8 mm. thick.

The chemical composition of the specimens used in this investigation was:—C, 2.20; Si, 1.10; Mn, 0.23; S, 0.033; and P, 0.172 per cent.

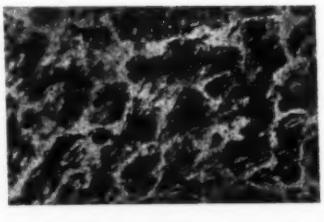
Micro No. 1 is that of the initial state of the specimen No. 1, and shows the microscopic structure of the white cast iron. The specimen was heated up to 900 deg. and kept for 25 minutes at that temperature, and was then cooled in the furnace down to the atmospheric temperature. The



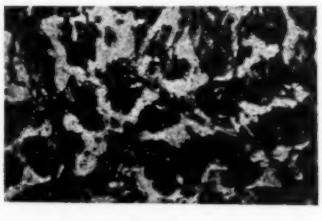
Micro No. 7, Sample No. 7. Cast in an Iron Mould X 100.



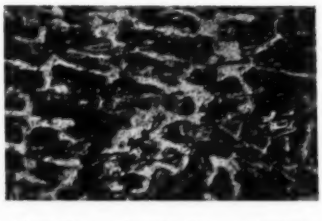
Micro No. 8, Sample No. 5. Cast in Dry Sand Mould X 100.



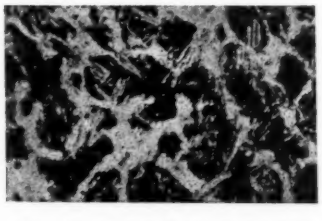
Micro No. 9, Sample No. 5. Cast in Sand Mould Heated to 800 Deg. C. X 100.



Micro No. 10, Sample No. 5. Cast in Sand Mould Heated to 1,000 deg. C. X 100.



Micro No. 11, Sample No. 5. Having a Thickness of ½ in. X 100.



Micro No. 12, Sample No. 5. Having a Thickness of 1 in. X 100.

dilatation-temperature curve accompanying the above heat treatment is shown in Fig. 1, the abscissa of which represents the temperature of the specimen and the ordinate the scale reading taken proportional to the dilatation. From this curve, it is clear that the A_{c1} transformation takes place at about 790 deg. The small expansion at 900 deg. is due to the graphitisation of free cementite in the white cast iron. The structure of the specimen treated as mentioned above is shown in Micro No. 2. The many small black specks are temper carbon graphitised from free cementite, from which it can be understood that the graphitisation begins chiefly from the boundary of the free cementite. If the time of annealing at 900 deg. is prolonged to three hours, the graphitisation of free cementite increases by half the amount of the first case as shown in Fig. 2. Micro No. 3 shows the microstructure corresponding to Fig. 2, from which we note that the initially separated carbon is coagulated together, while further graphitisation of cementite is taking place. If the specimen be heated for nine hours at 900 deg., the decomposition of free cementite is almost completed (Fig. 3), and temper carbon surrounded by ferrite appears scattered all over the pearlite ground (Micro No. 4). To obtain the black heart malleable cast iron, it is necessary to graphitise this eutectoid cementite in pearlite further. On the other hand, it is known from the iron carbon constitutional diagram, that carbon is contained in austenite as a solid solution, its amount varying with the temperature along the solubility line A_{cm}; so that, at a temperature beyond the A_1 point, the amount of free cementite which can be decomposed into carbon and iron is naturally determined by this line. Consequently, if we want to graphitise the eutectoid cementite it is necessary to cool it below the A point and to allow eutectoid cementite to be precipitated from austenite (or martensite) and then keep the material at a temperature just below the A_{r1} point for a sufficient time. Now, if the specimen shown in Fig. 3 be heated again to 900 deg. and kept for 25 minutes at that temperature, then cooled to the A point and kept at this point for 23 hours and a half, eutectoid cementite is graphitised completely as shown in Micro No. 5, which is the normal structure of malleable cast iron. An elongation observed at the A_{r1} point in Fig. 4 is due to the transformation and the graphitisation of eutectoid cementite, while that at 900 deg. is probably attributable to the diffusion of carbon into austenite.

In the foregoing experiment, the graphitisation of free and eutectoid cementites was effected step by step. However, the same effect can be obtained in one operation in the following way. Some specimens (No. 2), whose contents of carbon and silicon had somewhat increased, were prepared. They contained C, 2.74; Si, 1.29; Mn, 0.16; S, 0.038; and P, 0.092 per cent. The specimen was kept at the little higher temperature of 925 deg. to shorten the time for annealing, and then subjected to the following heat treatment:—(1) The specimen was kept at 925 deg. for three hours and cooled in the

furnace; (2) the specimen was kept at 925 deg. for three hours and cooled to the A_{r1} point, kept at that temperature for 10 minutes and then cooled in the furnace; and (3) the specimen was kept at 925 for three hours and cooled to the A_{r1} point, where it was kept for four hours and then cooled in the furnace.

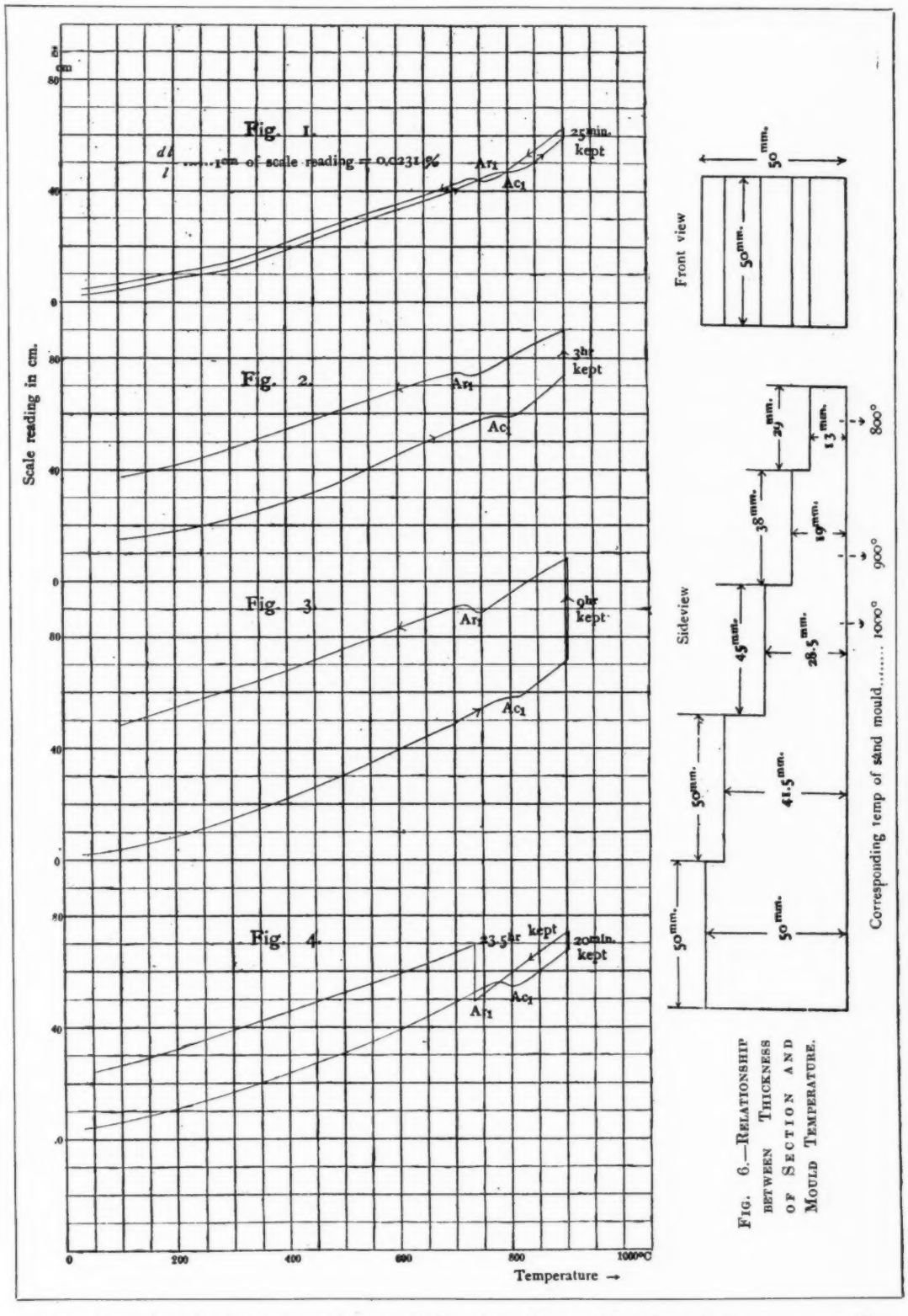


FIG. 6.—RELATIONSHIP BETWEEN THICKNESS OF SECTION AND MOULD TEMPERATURE.

In case (1) free cementite was completely graphitised (Micro photograph No. 6); in case (2) free cementite was completely graphitised and a part of the eutectoid cementite was also graphitised; in case (3) both free and eutectoid cementites were completely graphitised. The graphitisation obtained in case (3) was the same as that obtained in the case of the specimen as shown by the curves in Figs. 3 and 4. From the above results it would be convenient to distinguish the graphitisation of white cast iron into two stages, *i.e.*, the graphitisation of the free cementite taking place above the A_1 point and that of the eutectoid cementite which takes place just below the same point. For convenience sake, we may call the first graphitisation the first stage in graphitisation, and the latter the second. It is, however, necessary to notice that the first stage in graphitisation can also take place below the

A_{r1} point; for instance, if the content of silicon is fairly high or the specimen is heated at that temperature for a sufficiently long time, it may be effected at a temperature below the A_{r1} point. Moreover, the amount of carbon to be graphitised above the A_{r1} point is dependent upon the temperature to which the specimen is exposed, since the amount of free cementite which separates from austenite increases along the solubility line when the specimen is cooled from a high temperature. In the constitutional diagram for the iron-carbon alloy the eutectoid point lies at about 0.9 per cent. of carbon, but in the case of white cast iron which is used in the malleable iron foundry, where the silicon content is about 1.0 per cent, the eutectoid point, as well as the line of solubility of cementite into austenite, moves to the left-hand side or to the side of the less carbon content.* Hence a fairly large amount of further graphitisation will take place while cooling down to the A_{r1} point, even after the first stage of graphitisation has been completed.

The Effect of Temperature on the First Stage of Graphitisation.

The effect of the annealing temperature upon the graphitisation of white cast iron has been studied by H. E. White and R. S. Archer.† They kept the specimen at different temperatures for various periods of time. The amount of combined carbon was estimated by chemical analysis, and the results were confirmed microscopically. Since in their investigations and those of others the chemical analysis and the microscopic research constituted the principal items of study, the continuous change of phenomena which could be observed in the present dilatometric study failed to be observed. Ten specimens (No. 4) to be used for the above investigation were made by casting the melt in a sand mould, the chemical analysis of which was:—C, 2.72; Si, 1.29; Mn, 0.17; S, 0.034; and P, 0.096 per cent.

The specimen was made 13 cm. in length, and the lever-arm of the mirror 15 mm., as in the other cases. The heating rate was so regulated as to attain the desired temperature in about one hour, and the scale readings were taken every ten minutes, the temperature being kept constant. As the dilatation-temperature curves obtained in the present investigation were similar to those shown in Figs. 3 and 5, they are omitted here. It was found that the rate of graphitisation is slow at first, and attains a maximum value, which increases with the temperature at which the specimen is exposed, and then finally becomes gradually less towards the end; and also that the lower the temperature the more difficult it is for the graphitisation to begin. A relation between the time which is required to complete the first stage of graphitisation and the temperature is shown in Table I.

TABLE I.

Heating temperature.	875°	900°	925°	950°	975°
Time required to complete the first stage of graphitisation ...	9*h* 00*m*	4*h* 30*m*	2*h* 50*m*	2*h* 00*m*	1*h* 20*m*

The Effect of Temperature on the Second Stage of Graphitisation.

Regarding the second stage of graphitisation there have scarcely been any published researches; consequently, an investigation similar to that described above on the effect of temperature on this action was undertaken. The specimens used in this experiment were of the same chemical composition as that of No 2. The specimen was first heated to 925 deg. and kept at that temperature to complete the first stage of graphitisation; it was then cooled to the A_{r1} point in about 30 minutes, and kept at various temperatures below the A_{r1} point for a prolonged time, and the expansion due to the graphitisation of the eutectoid cementite was read every 10 minutes, till the action was completed. These curves have a different shape from that of the graphitisation of the first stage; that is, the graphitisation in this case takes place rapidly at first and then gradually settles down at the end. This action is also affected by the annealing temperature.

TABLE II.

Annealing temperature.	730°	710°	690°	670°	650°
Time required to complete the second stage of graphitisation ...	4*h*	5*h*	6*h* 20*m*	8*h*	11*h*

From Table II we can obtain a relation between the graphitisation and the temperature.

In practice, however, it is very difficult to keep a certain definite temperature during the course of cooling; and we are compelled to subject the specimen to the natural cooling in the annealing furnace. Hence, it is very important to investigate the cooling rate which ensures us the completion of the graphitisation of the second stage. If we draw a curve, taking as the abscissa the mean time required to graphitise one-tenth of the eutectoid cementite and as the ordinate the temperature of exposure, the shape of that curve is similar to that derived from Table II. Since the cooling of the annealing furnace takes place in the manner shown, it may be inferred that the eutectoid cementite can be almost completely decomposed in the course of the cooling.

In the above example, we have taken a specimen, in which the contents of silicon and of carbon are too large to be applied in practical cases, and its dimensions are too small; hence some corrections will be necessitated for practical application. In addition to the above fact, we must also notice that there is a heat evolution at the A_{r1} point due to its transformation, and the cooling in the A_{r1} range is somewhat hindered.

The Effect of the Thickness of a Casting on the First and Second Stages of Graphitisation.

In practice, it is generally recognised that the graphitisation of malleable iron is much affected by the dimensions of the casting. There has, however, been no investigation made on the reason why this is so, and to what extent it is affected. On examining the structure with a microscope, it may be observed that the size of the free cementite is much affected by the thickness of the casting, and hence we may expect that the graphitising action is dependent upon the size of the free cementite in the case of material of the same chemical composition. For an investigation of this kind it would be very desirable if we could make the casting of various thickness and machine it to suitable dimensions for the dilatometric analysis. Unfortunately it is almost impossible to machine white cast iron to make a specimen in the form of a thin, long cylindrical rod. Accordingly, in the present investigation, the specimens were made by casting the melt in a hot sand mould of a cylindrical shape. The mould was electrically heated to various higher temperatures, the cooling rate of the casting being thus regulated at will. Further, the structure of the specimen has been compared with those of different portions of a casting of a form as shown in Fig. 6, by means of a microscope. It can be seen that the size of the free cementite in specimens cast in a mould heated to different high temperatures changes parallel to those of castings having increasing grades of thickness. This corresponding relationship is shown in Fig. 6, Micros. Nos. 7 to 12. The materials used in this investigation had the following chemical composition:—

No. 5.—C, 2.47; Si, 1.07; Mn, 0.30; S, 0.018; and P, 0.132. *No. 6.*—C, 2.56; Si, 0.99; Mn, 0.19; S, 0.028; and P, 0.137.

(To be continued.)

* H. A. Schwartz, M. E. R. Payne, A. F. Gorten and M. M. Austin; Trans. of the Am. Inst. of Min. and Metal. Eng., 68 (1923), 916.

† Trans. of the A. F. A., 27 (1919), 351.

The Mould—Its Function and Preparation.

Lancashire Metallurgists' Views on Basic Problems.

At the conclusion of Mr. J. E. Fletcher's Paper on this subject, which we published last week, an interesting discussion followed, of which the following is an abstract.

MR. J. S. G. PRIMROSE said in one respect the lecture was lacking. They knew that Mr. Fletcher had been in Germany, and they had hoped that he would tell them in more detail about some of the points regarding high-duty iron, which he had mentioned were in dispute. For instance, the rate of cooling of the cast iron in a mould that had been preheated was an important consideration from the founder's viewpoint.

Reference had been made to filling in the cavity at the top of steel ingots. Had Mr. Fletcher been able to include in his investigation a method, recently reported, of getting a perfectly sound top by means of electrical heating, using an electrode and the molten metal in the ingot itself and the mould as the return for the electrical current? The method had been used in America, but not much had been heard about it in this country.

Vibration of Moulds Recently Filled.

MR. ONIONS said he thought the method of testing sand must be liable to many variations because of the delicacy with which it must be handled. Different individuals would get different curves with the same material. Was it better than the elutriation test? In that, one proceeded on a definite known principle and got various degrees of sand. It was a process resembling that carried out by nature, the effect of which could be seen at the mouth of every river that discharged into the sea. There was shingle first, then gravel, sand and clay. Elutriation was the same thing but carried out in a slightly different way. The lecture did not touch upon sand renovation. He had been told the reason they failed with sand renovation was that they did not know how to coat each individual grain of the sand as nature had coated it.

He had expected the lecture would deal rather more fully with the ordinary mould used in the foundry for making grey cast iron. He had often reflected on what would be the effect if, while the metal was liquid a heavy vibrator was put on the mould and the metal vibrated violently in the mould. If that could be done a good deal of trouble would be eliminated. Many times, if they knew what was taking place in the mould and could get at it to give it a little disturbance at the critical point, one would think it would overcome the difficulty.

Special Irons.

MR. FLETCHER said when he was over in America last year he heard about the electrical method which Mr. Primrose had mentioned, but he did not hear much about its commercial value or whether it really fulfilled all that was claimed for it. There might be something fundamentally important in it, but, like other problems which had been mentioned that evening, it had many sides and a good deal had to be done before one could say definitely that it was likely to be a complete success.

With regard to the heating of moulds and what that meant to a foundryman, of course, they were interested in the new German developments, and he would have liked to devote an evening to that subject. A good deal had been said about the Lanz Perlit process and the Emmel-Thyssen method of making cast iron. One might have a dominant pearlitic structure, but the mere fact that the heating of a mould caused slow crystallisation did not explain everything. Neither iron nor steel cooled in a straight-line curve; neither did a mould heat in a straight-line curve. When one dug deeply into the subject of cooling phenomena it was generally found that there were common critical points associated with both the mould and the metal. Although these critical points were controlled by the rate of mould heating or the rate of metal cooling, that rate of cooling was sometimes modified by certain properties of the mould and of the metal. People who very glibly tried to explain why a pearlitic casting was very often so wonderfully homogeneous had a little more to learn before they could say what it ought to be, or that it was not what it ought to be. That sort of discussion was very dangerous—dangerous to science. When a process was doing something different from what any other process had done before it demanded close attention, and the investigation should go as deep as possible. He might give his own views about the Emmel-Thyssen process, but he had got to this stage now, that he did not like to make rash statements to a scientific audience, or to any other audience. One knew so much about scientific methods, and at the same time so little. Those who had come in contact with Herr Zipp, of the Lanz Company, or with Herr Emmel, had met men who knew their business well and understood what they talked about. Both those men had been working on fundamentally scientific lines, but they had not told the world everything concerning their processes.

Sand Reclamation.

The reconditioning of sand was a most interesting point. Often a spent sand was sent to him to ascertain whether it could be reconditioned. Sometimes the grains were "dead"; that is, the clay-band envelopes were burned irretrievably. In the case he had in mind he got the firm to re-mill the spent sand, and, after the re-milling, tested to see whether there was any "live" clay released by the milling, as revealed in his test, by repeatedly washing the sand and re-sedimenting. The re-milling had broken the old grain envelopes and had revealed some unburned clay, consequently there was a little life left in that spent sand after milling. That did not mean that such a result was always obtained by re-milling. He knew that in many cases it could not be done. The re-milling of spent sand in a small laboratory test was often a very different thing to the milling of sand mixtures in a large runner mill dealing with different types of sand. One had to bear in mind that the abrasive material in the milling of a sand was the silt; the mill used that silt like emery powder to rub off the bonding clay, often to the detriment of the sand.

It was very useful to practical foundrymen to understand such fundamental points. They would not find out how to recondition sand until they understood more about the actual structure of the minute clay and silt grains. He could not explain all that was in his mind, but in developing his little dry test he had found many points of interest suggestive of means for the reconditioning of sands. That was one of the values of that little dry test. It might interest the younger men in the foundry industry as showing how a very cheap and simple apparatus sometimes told wonderful tales.

He had no fault to find with the elutriation method except that it often took a very long time to carry out an investigation. With his own method the curves told the tale quickly. The lower sediment curve, where it was continually changing its direction, told him that that sand was composed of an almost infinite number of grades, and were not arranged in a series of uniform-sized grains. The advantage of the wet subsidence method was that he could tell at once whether the silt in his sand was a coarse silt or a fine silt, or a mixture of everything between the coarsest silt and the finest silt or the coarsest clay.

If a clay was analysed they would find it not by any means all clay substance (kaolinite), for it contained from 45 to 50 per cent. of silica and up to 20 per cent. of alumina. Estimating the composition mineralogically, one found the clay contained a certain percentage of silt. The upper curve told that story very clearly, and was a valuable index to the characteristics of the bonding material in a sand.

XUM

Vibration of Moulds

The vibration of moulds was of interest. Many years ago Dr. Stead used to say if they could vibrate their ingot moulds they might get wonderfully better results in the sense of homogeneous crystallisation. But he (the lecturer) had never found any practical means safely to vibrate an ingot mould, and it would be inconceivably difficult to vibrate sand moulds. Most of those present remembered seeing recently an illustration of a receiver in front of a cupola where the metal itself was vibrated. The idea was theoretically right, but he should not like to pay the upkeep cost of the linings for that receiver.

MR. SHERBURN said he had read many Papers on moulding sands, but from none had he gained so much information as he had done on this occasion. There were great potentialities in this method which Mr. Fletcher had shown, and he hoped it would enable them to learn much more about moulding sands than they knew at present. Interest in the investigation of this subject would be stimulated if sand cost £5 per ton, and much more attention would then be given to the reconditioning of sand. In the past the determination of the question whether a sand was right or wrong extended over a long period. If they had this new method in routine use the information it afforded would be very useful in negotiating with the sand people.

Floor Sand is Variable.

MR. A. L. KEY agreed that the lecture had been very enlightening. There was much to be learned from the processes shown, which should also be of very great assistance in determining the type of sand to be purchased. He was prepared to believe that by this method of testing they could get accurate results. But scientific testing was not scientific control, as it was not commercially practicable to test every load that came into the works. Suppose three loads came in during a period; although they came from the same quarry they probably would differ in composition, and only one load might be satisfactory if it had to comply with the analysis of some sample previously taken from the same quarry.

When making facing sands, it intensified the difficulty of control, in so far as a foundry whose range of work varied from castings of a few ounces weight to 20 tons weight. The variations in the composition of the black sand from different parts of the foundry was considerable, and unless one treated practically every barrow of black sand (which was almost impracticable), control was lost. In the case of shops running on standard work of repetition nature the possibilities of control were quite possible.

Dealing with the casting of the angle plate, Mr. Fletcher had suggested that the defect at the corners was due to the heating of the sand. With that statement he could not quite agree. In his opinion this condition was largely brought about by the method of introducing the molten metal into the mould. This subject of filling moulds at the right point, speed and temperature was usually missed by nine out of every ten lecturers, yet in the main the success of obtaining a sound casting was largely controlled by the correct method of filling the mould.

MR. FLETCHER said the case of an angle bracket or angle plate was one of particular interest. Last year he was at the works of M. Ronceray. A man who had been a foreman there for years had given up that job and had gone back as a journeyman at a smaller wage in order to study some of these problems. It showed the interest which French foundrymen were taking in the scientific side of foundry work. For many months that man had been doing nothing but making angle iron plates and trying to find out how to get rid of the porosity trouble at the corner. He had not succeeded at the time he (Mr. Fletcher) arrived there. He (Mr. Fletcher) examined castings from all parts of the country continuously, from small malleable ones weighing a few ounces to big ones weighing many tons. Amongst the malleable castings there were a number of wasters due to that very cause. So long as the fundamental causes of such defects were not understood the trouble would continue. In the case of white-fracture irons the metal solidified so rapidly that unless regard was paid to that point there was sure to be sponginess in that corner. It might be less with a thin side and a thick side than if the two sides were equal, but trouble there would be in some degree unless proper precautions were taken.

Quarry Carelessness Causes Foundry Defects.

With respect to the scientific control of moulding sand, be maintained that if they were to see that the material bought from the quarries was right, by such a test as the one he had shown, assisted by elutriation if desired, or by any other method which would have the same result, it was necessary to know the mechanical analysis of the sand as sampled from every horizon in the quarry. At the foundry of a large engineering establishment he was told there were a number of jobs they could not make satisfactorily with the sand from a particular quarry. Knowing the quarry, he replied that it could be done if they got the right stratum. On investigation he found that the quarryman had not gone deep enough to strike the stratum which was suitable. They had done so now, and the right sand was being obtained. It was not the fault of the scientific method of testing if the results of loading up sands from different strata gave poor moulds, but that kind of thing caused foundrymen a vast amount of trouble, and it was far too common a practice. Change the quarry if you cannot get anything better than sand mixed from good, bad and indifferent layers. Otherwise the position resembled that of a man who wanted a casting to stand a certain test but said he was obliged to use a certain pig-iron, although its use would produce poor castings. The real reason probably was that that pig-iron cost 5s. per ton less than the better iron required. The financial question entered into all foundry problems, and many engineers and buyers had got into the way of expecting high-quality castings at such a low figure that good material could not be used. He could find foundries where the cupola used the minimum of pig-iron; it was mainly scrap, and if anyone could say what there was in a large proportion of the scrap one bought to-day he would be glad to hear it. And in many cases it was as difficult correctly to sample the moulding sand as to sample the scrap iron simply because it was so mixed up. It was done for purely commercial reasons. That made it all the more necessary to use every possible means to find out what the sand as bought and used really was. The virgin sand required to be dealt with as well as the facing and floor sands.

Much depended on the man who mixed the facing sand. If he wanted to use too much of his own spent sand and too little of the new good sand, and he got bad results, he had himself to blame; he must not blame the original test of the virgin sand.

Restoring Spent Sand.

MR. SUTCLIFFE stated that he had restored spent sand by throwing clayey water on it for about a month. He never milled it. Had he done so and used it he would have been asking for trouble.

MR. FLETCHER said there was no prescription that would meet every disease of the jobbing shop, especially with respect to sand. He hoped there would be no misapprehension of what he had said about the experiment of milling spent sand. It was done to find out whether milling helped to revive the sand or not. In this instance he had to tell the people that the sand was of no use and should be scrapped. Once the sand had become over-silted and the envelopes of the grains burned there was no chance of getting a fine blue skin on the casting. There was a great deal of difference in the treatment of the sand used in various districts; also, even when foundries within a few miles of each other were using the same moulding sand entirely different results were got.

THE CHAIRMAN (Professor Thompson) congratulated Mr. Fletcher on having devised a useful test. As far as he could see at the moment, this being the first time he had come across it, there was no other test which would give the same amount of information in so short a time. He would like to have a further explanation of the chart.

The explanation was given by Mr. Fletcher, who observed that in tests of this sort the interpreta-

tion of the results was the really important matter, and one must be guided by experience. That was a reason why it was so difficult to explain to the practical foundryman the many-sided character of scientific tests. The application of scientific knowledge was often as difficult as the furnishing of a scientific explanation of apparently simple phenomena. Meetings of this kind were excellent because they enabled men who had a purely scientific bent to get in touch with practical aspects of works problems, and those who were practical, or, maybe, pursued rule-of-thumb methods, were given an idea of the scientific reasons which bore on the operations they carried out in the course of their works life.

Foundry Purchasing.—II.

By Eric N. Simons.

Having, it is hoped, successfully disposed of the objections to a central purchasing office, one may now consider how best this department may be established. It is important to remember that on the manner in which the innovation is made will depend to an enormous extent its eventual success. In some establishments, the central buying office has been instituted by autocratic decree of the management, a buyer has been appointed, an office fitted up, and the individual departments ordered to send all requisitions in future to the buyer. What has been the result?—disappointments, delays, irritations, and loss—difficult to trace to their source. But it is easy for the observer to indicate this source. In brief, instead of co-operating to aid the work of the buyer, and incidentally to relieve themselves of much tedious work, the various departmental heads have quietly and without fuss thrown every conceivable obstacle in his path. They have not, perhaps, taken active steps to throw his plans out of gear, but have merely refrained from extending in even the slightest degree their co-operation or assistance: in other words, they have refused to grease the wheels, if they have not actually thrown sand in among them.

The reason for this short-sightedness is, of course, jealousy, combined with a certain resentment against the management for thus arbitrarily taking out of their hands work that, whether rightly or wrongly, they believe themselves to have done satisfactorily. But it is possible to go to work in such a manner that instead of hindering the full efficiency of the central buying department, the managers shall welcome its inauguration and consistently co-operate in its smooth functioning.

How this happy result can be achieved needs description. In the first place, it is essential to remove from the decision of the management to establish a central office any suggestion of the following things:—(1) Favouritism for a particular employee; (2) distrust of the efficiency of those who have, hitherto, carried on buying operations for their particular departments; and (3) sheer autocracy. This can best be done by making every former departmental buyer to some extent responsible for the final inauguration of the central department that relieves him of some of his responsibilities. In other words, before any decision is announced by the management, or suspected to have been reached in advance, the departmental managers who have been in the habit of buying for their own sections should be invited to a meeting. Either a director, the general manager, or some other person of authority, should preside, to show that the management are seriously interested in the question, and that they fully intend to give effect to the agreements reached.

Instituting a Central Buying Organisation.

At this meeting the chairman should give a succinct account of the financial and material advantages to be gained *by the firm* from the establishment of a buying office. Above all things he must stress the advantage to the firm as a whole. Only thus can he succeed in convincing his subordinates that this is the point of view they must take. If he wanders from the point, or allows other considerations than that of the ultimate benefit of the firm to intrude upon his arguments, he will fail to rouse a cordial response. As a general rule, men in charge of departments are loyal to their employers, and willing to some extent—if handled in the right way—to put their personal hankerings aside in favour of some action that will increase the success of the firm. But to this end, it is essential that their minds shall be kept firmly on the main issue.

Thus far the chairman has indicated broadly the advantages of the central department. He has stressed the benefits to the firm. What must he say next? He must produce his proofs. He must cease talking generalities which, if persisted in, end in arousing scepticism. He must not say that reading this book or that journal has convinced him that such a scheme as he is proposing would be advisable. He must not ask the audience whether they agree with him. He must not say that he and his colleagues have come to the conclusion that it is time they established this buying department. He must not utter stale platitudes about progress and efficiency and system. What he must do is give chapter and verse, facts and figures, showing what economies can actually be effected by such a change as is suggested. This is not difficult. By collecting in advance from each department such statistics of its recent purchases as it possesses; by classifying and analysing these statistics; by judicious inquiring among suppliers, and so forth; information can be obtained to show roughly what goods, if ordered in larger quantities, could be obtained at lower prices. The accountant should be called upon to supply figures concerning the number of different accounts running through his ledgers with supplying firms, and the number that could be eliminated were buying more standardised. What this means in clerical work, postage, cheque costs, and so forth, should be briefly outlined. In short, the chairman should be able to say to the meeting: "Gentlemen, on a conservative estimate, the firm could save £—— every year by the establishment of a buying department. Can we afford to ignore that possibility of reducing our expenses?" And if he has handled the meeting in the right way, if he has taken the trouble to secure the right facts and to present them clearly, the probability is that the meeting will answer "No."

Assuming this stage to have been reached, the next step is for the initiator of the scheme, whether it be this chairman or a colleague, to exercise tact in preparing the minds of the departmental managers for the change over. He must be careful to praise them for the work they have done in this direction in the past, and to point out that the management's desire to relieve them of it is not due to disbelief in their ability to do it well, but to a desire to free their hands for the performance of work more immediately important. The clerical character of some of the work of which they are being relieved should be indicated, and the instances in which they will still retain some control over buying—as in the case of highly technical requirements—should be enumerated. Finally, an appeal for their co-operation should be made, and with this can be combined an intimation that to a certain degree they will be required to take an active part in the work of buying economically.

If the preliminaries have been carried out in this way, there is little reason to doubt that the meeting will be favourably disposed towards the scheme. But there are bound to be some objections, and demands for more lucid treatment of certain points. Discussion should be allowed, but kept within legitimate bounds of subject and time. Questions and arguments should be answered fully and tolerantly. And in the end, the managers, by their assent, tacit or otherwise, to the inauguration of the buying office, will be unable to refuse a share in the responsibility for its existence, and having been consulted beforehand, will be less resentful and obstinate in its regard.

The Registered offices of the British Cast Iron Research Association, hitherto at 75, New Street, Birmingham, together with the laboratory at 56, Guildford Street, Birmingham, have now been removed to 24, St. Paul's Square, Birmingham, to which address all communications should be sent. The telegraphic address is "Cira, Birmingham," and the telephone number Central 1885.

Institute of British Foundrymen.

LONDON BRANCH.

Formation of Junior Section.

A Junior Section of the London Branch of the Institute of British Foundrymen was inaugurated at a meeting held in the offices of the Institute, 38, Victoria Street, S.W.1, on Friday, October 29. The meeting was presided over by Mr. V. C. Faulkner (President of the Institute), other members of the Senior Section, including Mr. H. G. Sommerfield (Hon. Secretary), being present.

An encouraging address was given by Mr. Faulkner, of which the following is an abstract:—"When you join a Society of this kind you want to know exactly what there is to get out of it. That can be answered in one sentence, namely, what you put into it. A Society of this character is to be moulded by yourselves, and, whilst you may be sure that there is in London a great reservoir from which you can draw for lecturers and other help, the actual work of the Section must be of your own making. You will find that the advantages of a Society of this nature are recorded as being the study of scientific problems and the reading and discussing of Papers, but the real advantage is in the friends you make by being a member, and they will help you in your work.

"I, personally, have found that any progress I have made in life is largely due to the kind friends I have made in the foundry industry. They have helped me in the past and will help me in the future, I feel sure, and the whole of the knowledge I have collected from my friends is available to anybody joining the Institute. There are many who are very willing to help in anything in the form of education, and some are so enthusiastic that they are willing to come as far as from the North of England to talk to you boys. They are willing to do this because they realise that in the past people have done it for them, and this, to my mind, is the real advantage of the Institute. You come into contact with people who are interested in similar problems to those which from time to time cause you anxiety.

"The Institute has made contact with foundry societies of other countries, including America, Germany, France, and Belgium. By joining it you are really becoming a member of a very large body, and if you go abroad you will always find plenty of friends there. I can assure you it is impossible for anyone like myself, for instance, to go into any large town throughout the world without finding some friends whom I have made through the Institute.

"We establish these friendships in our Institute by having annual conferences. As you get on in your work you will find you will be given opportunities of attending these conferences, which are held all over the country and sometimes abroad. Papers are presented on behalf of foreign Associations, Papers which represent the latest views of those countries, and they are written by specialists on different subjects. It is only four or five years ago since we started this system of relationship with the technical societies of other countries, and at least 150 Papers have been exchanged already. You will find that your interest in the technical aspect of the industry will increase, and I hope you will read the technical journals which are available for you. In addition to all foreign exchange Papers you will find set out from week to week by the technical Press all the translated thought of your colleagues in foreign countries.

"As for actual teaching of foundry practice, we cannot hope to do that. The proper place to learn to make castings is on the foundry floor, and the proper place to get technical training is at evening classes. All that this Institute can do is to give you an added interest in your work. We will supply you with various lecturers to help you to become more interested, and you will have a good information bureau from which to draw, but you must not expect to learn your trade there."

Mr. H. G. Sommerfield said he endorsed Mr. Faulkner's remarks, and thought that classes, however good they were, did not reach far enough. An Institute like theirs could go a great deal further, and there were fine prospects for a Junior Section in London. There was the difficulty of distance to be coped with, however, but they had approached some 60 firms round London and had received very gratifying replies from most of them, saying that they would do all they could to encourage their young men to attend meetings, and in some cases had even offered to pay expenses.

The one important thing, however, was enthusiasm, and if the members lacked that there would be no progress made at all. They thought that the London Branch was quite justified in having a Junior Section. Therefore he had great pleasure in proposing that a Junior Section be formed in affiliation to the London Branch of the Institute of British Foundrymen.

Mr. Robert Shaw seconded the motion, and also referred to the point about friendship. It was his opinion that if they were all willing to help each other, progress was bound to result. An Institute like theirs must not take the place of classes, however, because classes would still be just as necessary.

All would depend upon themselves and the enthusiasm they put into it as to how successful their Junior Section would be.

Mr. J. E. Ellis also supported the motion, saying that it was not a large number of members they wanted so much as a few enthusiastic ones, and if they had a few really enthusiastic young men in their Junior Section, there was every hope for the future. It was up to those present to get busy, and he thought they could look forward to having a very successful Junior Section.

Mr. A. F. Gibbs also made an encouraging speech. He thought it was a splendid thing to have a Junior Section, as one knew, from a life's experience, that it was much easier for people to pick up knowledge than when they were young.

It was then unanimously agreed that a Junior Section be formed in connection with the London Branch of the Institute of British Foundrymen.

Election of Officers.

Mr. Faulkner proposed that Mr. F. P. Hull be elected President for the session. Mr. Hull had originated the idea of having a Junior Section of the London Branch, and they were all indebted to him for same, and felt that he would make an excellent Chairman. The proposal was seconded by Mr. Phillip Ellis and carried unanimously.

Other officers were elected as follows:—Vice-President, Mr. Phillip Ellis; Hon. Secretary, Miss M. D. Pittuck; members of Council, Messrs. V. C. Faulkner, H. G. Sommerfield, R. Shaw, A. F. Gibbs, F. Cummings, R. A. Gore and W. J. Cadge.

Before the meeting closed a very hearty vote of thanks was accorded to Mr. Faulkner for being present that night and for his kind help in the formation of a Junior Section. Mr. Sommerfield was also thanked for the work which he had put into it.

The first General Meeting of the Junior Section will be held at 8 p.m. on Friday, November 26, at the offices of the Institute of British Foundrymen, 38, Victoria Street, Westminster, S.W.1, when a lecture will be given by some prominent foundryman, the subject to be announced later.

Application forms for membership of the Junior Section will be obtainable from the Hon. Secretary of the Senior Branch (Mr. H. G. Sommerfield, Charterhouse Chambers, Charterhouse Square, E.C.1), or from Miss M. D. Pittuck, c/o Mr. H. J. Young, F.I.C., 3, Central Buildings, Westminster, S.W.1.

It is hoped that as many application forms as possible will be completed and sent in to the Secretary of the Junior Section some time before November 26, so that they can be dealt with at the Council meeting on that date.

Some Phases of Foundry Education.

The winter session of the Sheffield Branch of the Institute of British Foundrymen was opened at the Albany Hotel, Sheffield, on October 15. Commander L. Jackson, the retiring Branch-President, in welcoming his successor, Mr. George Edginton, of Chesterfield, said that if the members showed to Mr. Edginton the same loyalty as they had to him during the past twelve months Mr. Edginton would have a successful year. Commander Jackson thanked the members for the manner in which they had supported him during his presidency.

Giving an address on "Education in the Foundry," Mr. Edginton said:—

COMMANDER JACKSON AND GENTLEMEN —

On taking over this responsible position of President of the Sheffield Branch of the I.B.F. I recognise the amount of work that has been done by past Presidents, also how dependable I am upon the members of the Branch Council and also the assistance of the members in general. Past Presidents have been happy in having the support of a loyal and enthusiastic Council. With their continued help, I look forward with some confidence to the future session.

The Sheffield Convention.

The Sheffield Branch, and the Institute as a whole, continues to make good progress. Next year the Convention is to be held in Sheffield, when Mr. Goodwin will be raised to the Presidency of the Institute, an honour which the Sheffield Branch appreciate. This also means a vast amount of work to be done to make it a success, and all the members are invited to give what assistance possible to bring this about.

A Triple Aspect.

The object of the Institute is to educate, and the results up to now have been very encouraging. Much more remains to be done in at least three directions. Our first object must be to educate ourselves and those associated with us in every department of the foundry work. Something has also to be done in the education of those responsible either directly or indirectly for the design of the work which the foundry has to carry out. A third requirement is the education of those who are placed in our care, the youthful students of foundry work, upon whom will rest the future responsibility of maintaining the foundry trade of Great Britain in the premier position in which it stands at present.

Some wise words spoken by a historian are particularly applicable to foundrymen. It is said, every person has two educations, one which he receives from others, and one, the more important, which he gives himself.

This Institute can be of the greatest value in assisting the kind of self education to which this man refers, and every member should determine to use the help afforded by the reading of papers and taking part in discussions at the meetings, as well as the exchanging of views and opinions amongst members, and in encouragement given to the study of metallurgy. To the technical knowledge acquired in various ways, must be added the cultivation of the faculty of observation. It is obvious that many discoveries have been made, and can be made, and much detailed information secured solely by observation.

Designer's Education Defective.

A good deal may be said with regard to the education of designers of castings whose duty is to specify precisely the work required from the foundry, and who are responsible for the character and general lines of machining called upon. Certainly the designer is in as much need of training as the foundryman. This he does not get. If the design is faulty, the best workmanship will not produce a satisfactory result, and it is equally useless and unfair in such cases to blame the foundrymen or the workmen. Something further is required in the training of draughtsmen. As a rule a boy enters the drawing office straight from school; he is probably a boy who has done well there. He commences to learn to draw, he seldom has any direct intercourse with the shops. I know one or two firms who have boys in the fitting and machine shops, for a couple of years, but very few get any foundry training, he is therefore quite ignorant of the work done in the actual production of castings. He may be quite diligent in picking up the technical school knowledge as regards applied mechanics, mathematics, etc., but he knows very little about metallurgy, or crystallisation of metal or the practical work of the foundry and pattern-shop. The result is that his designs are very often ingenious but not very practical. A fact frequently commented upon is the general success of American designs. Whilst transatlantic machines are pleasing to look upon, and are doubtless suitable for the work they have to perform, they are produced with a view to low expenditure, both in patternshops and the foundry, and in respect to the time of moulding and the material used. The result is materially due to the great interest which American engineers generally takes in the foundry and pattern shop, and the assistance which the engineer gets from the numerous technical colleges which are such a feature in America. In Great Britain we are beginning to see the importance of practical up-to-date teaching in regard to foundry and kindred subjects.

Metallurgists Require Additional Training.

There are several technical schools and universities giving instructions on practical foundry matters. In Sheffield we have a foundry equipped for teaching metallurgical students, but, of course, this is on a limited scale, and if not well carried out the student will prove the old adage that a little knowledge is dangerous, and when he emerges into practical life he will probably find this knowledge of very little use to him. For metallurgical students I would advise a study of the effect of design on the structure of metal in the castings, and such a course could easily be arranged, and its effect would implant into the mind of the student clearly defined ideas as to what type of designs to avoid, and he would gain something that would help him during the remainder of his career. In large engineering centres like Sheffield a committee could be formed consisting of professors, teachers, and practical foundrymen, who could combine their energies into framing from time to time a syllabus of work likely to be of practical use. Designers put so much on paper that is troublesome and tedious to the foundry, and at the same time very expensive to make. I have in my mind at the moment some designs we get at times from marine engineers. They are very fond of bosses and ribs which are all screwed on, and the moulder has to keep taking them out as he rams the job. One in particular had 28 bosses around the gland mouth of a turbine casing of not more than 30 in. dia. We suggested a continuous facing all round to do away with this. They readily complied with this modification when it was pointed out to them. There is no doubt much money and time can be saved in both pattern shop and foundry if engineers had a little more knowledge of foundry practice.

Training of Apprentices.

The training of apprentices under our care constitutes a most important responsibility, deserving of careful consideration. Although foundries to-day are better equipped, better lighted, and kept cleaner, we are getting a less number of boys taking up foundry work. What is wrong with the foundry? Why is it we cannot attract the better educated boys to the foundry? Or why cannot we keep those we get? In our own foundry, which is fairly modern and well equipped, so that a great deal of the drudgery is taken out of it, we have the greatest difficulty in getting boys to stay. They come for six months or probably a year, then they leave us and go to the collieries, or ask to be taken into the machine or fitting shops, which are already over-crowded with boys. The wages are much higher for boys employed at collieries, and this, to my mind, is one of the reasons. Sometimes they are encouraged by their parents, who are finding it a struggle to keep growing lads

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on the wages paid during the first few years of their apprenticeship. More often it is boys whom they associate with who work in the pits and have more pocket-money, and this he feels very much. There is no doubt if the foundry industry it to hold its own something will have to be done to attract the boys to the trade. It seems to me craftsmanship is at a discount where more repetition work is done, and if piece work rates can be paid to boys there are not the same difficulties existing as in the jobbing foundries in getting boys to stay, although it means very often when they become men they are of little use except as machine moulders and repetition moulders. It becomes more serious each succeeding year, as good jobbing moulders are more difficult to get. As time goes on and the old school go out, how are we to fill their places unless something is done to keep boys in the trade? I think there is far greater scope for the better educated boy who will take up metallurgy than any other department in the engineering trade, and something will have to be done to solve this problem, as the engineer is asking for more intricate castings, increased strength in castings, and generally more exacting tests are being called for.

In almost any foundry one will find that the skilled jobs are being done by relatively old men; this gap wants closing up by better training for our young men. It should be our care in the interests of trade and students of practical foundry work to see that they make the most of the period of youthful training passed in our workshops. The special vocation of the Institute of British Foundrymen is to produce that alertness of mind and the spirit of continuous investigation which enables the ambitious young workman to make a continuous progress.

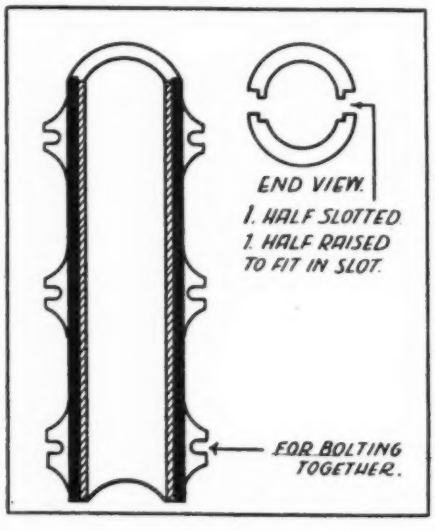
We believe the average British moulder is second to none, but if we are to maintain the premier position we must produce a class of still abler workmen, and strict attention must be paid to the general education of those whose business it will be to initiate, control, and carry out the work of production in the foundry to which we belong, and of which we are proud.

Foundry Query.

Casting of Brass Bars in Iron Moulds. *Page 302.*

Having had considerable experience in the casting of brass, gun-metal and phosphor-bronze bars in iron moulds, my experience is available for "Dominion Founder."

In the first place he will require two half iron moulds, such as is shown in Fig. 1, which can be bolted together. They should be slightly warmed,



and the inside dressed with an oily piece of waste, and dusted over with ordinary flour. After bolting together the two halves, a runner bush is put on the top and the metal cast whilst the mould is warm. This practice I have found has been very successful in producing good, sound, clean bars. Also the same method can be adopted for bars with a core running through to enable one to get sleeves any length that may be required.

H. HAMBLIN.

55, King Edward Road, Rugby.

Catalogues Received.

Mould Drying Stoves.—Mr. Sydney Evans, of 9, Bush Lane, Cannon Street, has sent us a folder which describes and illustrates a line of coke or breeze fired mould driers. Castings and moulds are detailed, together with the quantity of coke consumed.

Boiler Scale Removal.—We have received from the Actinium Developments, Limited, of Alder House, Aldersgate Street, London, E.C.1, a pamphlet describing an entirely new method of dealing with the removal of scale from boilers. A canister is supplied which is suspended in the feed-water tank and because of some curious force the scale is rendered in such a condition that it either drops off or is in a loose powdery condition that it can be brushed off. Most preventives for boiler scaling are successful only in certain areas, but the wide territory from which the testimonials have emanated lends much weight to the claims set forth.

Sands, Clays, etc.—Mr. A. L. Curtis, of Westmoor Laboratory, Chatteris, has, in the second edition of his catalogue, made some additions so as to include minerals other than sands. To these he gives the comprehensive appellation economic minerals, but even this is insufficiently wide, as steel shot has been included. The catalogue is arranged alphabetically, a system which does not appeal to us, and we suggest that grouping by industries would be preferable. This would become more and more advantageous as time went on, as, say, the at present scattered section on foundry sands could be reprinted and circulated to foundries without the carrying of a large amount of extraneous matter. Another suggestion is that the utility of the catalogue could be increased by modifying the contents list, which appears on the back cover, so as to contain a few cross references. For instance, for moulding sands one is referred to page 19. Under the proposed system the reader would be referred to pages 6, 9, 10, 13, 14, 18, 19, 20, 21, 22, 23. Abrasives could be similarly treated. The value of this catalogue, however, lies in the fact that most people have more than one interest. Should a foundryman possess a garden or a canary, he will probably discover a new and reliable source of supply of sands used in these connections. The brochure contains 32 well-illustrated pages, and is jacketed in slate-blue stiff backs.

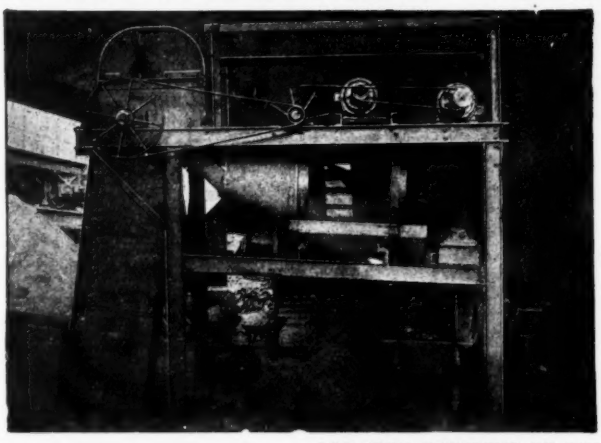
First President of London Junior Section of the Institute of British Foundrymen.

MR. F. P. HULL, of Mitcham, Surrey, has been elected the first President of the newly-formed Junior Section of the London Branch of the Institute of British Foundrymen. Mr. Hull, who is the elder son of Mr. F. N. Hull, Commercial Editor of the "Iron and Coal Trades Review," was educated at the John Ruskin Technical Institute at Croydon, and the Wimbledon Technical Institute. Some years ago he joined the firm of Ronald Trist & Company, Limited, and received a training in the manufacture of power saving appliances, subsequently going to the Southern Foundries at Waddon, Croydon.

THE MANY FRIENDS of Mr. Gordon Duguid, of T. E. Gray & Company, Limited, will learn with regret that he is lying seriously ill with pneumonia, scarlatina and diphtheria.

MR. H. H. BIRD, chief assistant to the resident engineer at Cardiff Docks, owned by the Great Western Railway Company, has been appointed to the position of assistant divisional engineer at Shrewsbury.

A REVELATION TO IRONFOUNDERS



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Trade Talk.

WILLIAM DOBSON & COMPANY, LIMITED, of Walker, have received a contract for the building of two cargo boats.

A COMPANY HAS BEEN FORMED for exploiting the iron ore deposits in Cambodia, French Indo-China, with registered offices at Saigon.

THE MOND NICKEL WORKS at Clydach, Swansea, closed down on October 29, in consequence of the prohibitive cost of production.

AT A MEETING of the Birmingham Branch of the Society of Technical Engineers, Mr. Richard Hazleton, general secretary of the society, delivered an address on the Engineers Bill now before Parliament.

THE INTERNATIONAL FOUNDRY EQUIPMENT COMPANY, LIMITED, have taken over new works at the Canton Works, Young Street, Sheffield, having removed from their old address at 132, Steelhouse Lane, Birmingham.

A MEETING OF MEMBERS of the Sheffield Metallurgical Association was held last week, Mr. T. G. Elliott presiding. In a lecture on laminated springs, Mr. T. H. Sanders, of Leeds, dealt with laminated springs as used upon railway and road vehicles, referring to their design, manufacture, spring steel qualities, testing, working deflections, and service failures.

THE OUTPUT of Clyde shipyards during October consisted of only four vessels of an aggregate of less than 13,000 tons, making a total for the ten months of 112 vessels of about 256,550 tons. There were launched all over Scotland eight vessels of 15,535 tons. Of these, four of 12,878 tons were built on the Clyde, three of 2,697 tons on the Forth, and one of 20 tons at Fraserburgh.

THE MASTER CUTLER (Mr. David Flather) and his guests were on October 29, in accordance with custom, afforded an opportunity of seeing something of the armament and heavy steel trade of Sheffield, Vickers, Limited, inviting a large party to visit their River Don Works. The Master Cutler was accompanied by the Attorney-General (Sir Douglas Hogg, K.C.) and many other of his guests.

A RECEIVERSHIP FOR THE Nova Scotia Steel and Coal Company, Limited, a subsidiary of the British Empire Steel Corporation, Limited, has been refused by the Nova Scotia Supreme Court. Judge Carroll said he did not consider a case of jeopardy existed on the facts submitted. He referred to the company as a going concern and a live corporation without peril to property. The application for a receivership had been filed on behalf of the mortgage and debenture holders.

THE CHIEF INSPECTOR OF FACTORIES has issued a notice under the Grinding of Metals (Miscellaneous Industries) Regulations, 1925, to the effect that, being satisfied in respect of portable grinding machines, portable glazing machines and portable buffing machines (i.e., grinding, glazing and buffing machines without fixed foundations or suspensions, which are carried or propelled to the work) that, owing to the special conditions under which such machines are used, compliance with the requirements of certain of the above regulations is at present impracticable, such machines are exempt from No. 1 and No. 17 of the Regulations.

EXPENDITURE of £1,000,000 in the establishment of new works at Newcastle for the manufacture of steel pipes and fittings is contemplated by Stewarts and Lloyds (Australia), Limited, in co-operation with the Broken Hill Proprietary Company, Limited. Provided adequate tariff protection is granted, erection of the works, it is understood, will be commenced with as little delay as possible. Stewarts and Lloyds (Australia), Limited, have been manufacturing wrought iron tubes in Australia for many years. Mr. McLay, one of the company's works managers from Scotland, is in Australia. He is going into the matter of the establishment of the new works at Newcastle with the Broken Hill Proprietary Company, and the Australian manager of Stewarts and Lloyds, Limited (Mr. C. Thomson). Both Mr. McLay and Mr Thomson are at present in Melbourne. Whether the Australian company of Stewarts and Lloyds will put down the works, or whether the Broken Hill Proprietary Company will participate, is a matter that is under consideration. The new establishment would have to depend upon the Broken Hill Proprietary Company for the steel from which the pipes and fittings would be manufactured. The principal products to be turned out are steel water pipes, gas pipes, boiler tubes, and artesian bore tubes. It is not intended to manufacture brass or copper tubes.

THE COMMERCIAL WELDING AND ENGINEERING COMPANY, LIMITED, has been placed in voluntary liquidation. Mr. A. B. Watts, 15, Windsor Place, Cardiff, has been appointed liquidator.

Obituary.

MR. J. LONG, manager of the Midland Ironstone Company, Frodingham, died on October 31 at Scunthorpe.

MR. R. N. LENNOX died on November 1 at 12, Manor Park, Lee. He was a director of the Lennox Foundry Company, Limited, of the Tantiron Foundry, Glenville Grove, New Cross, London, S.E.8.

MR. T. B. ROGERSON, a director of James Dunlop & Company, Limited, has died at his residence in Bridge of Allan. Mr. Rogerson, who was an ex-president of the West of Scotland Iron and Steel Institute and was an authority on blast furnace practice, received his early training in Middlesbrough.

MR. W. ROSS, engineer, of Summerfield, Dalkey, died last week. He started his engineering career at the North Wall Iron Works, Dublin, early in the 'seventies, and his business developed into the company known as Ross & Walpole, Limited, of which he was the chairman and managing director until his retirement three years ago. He had been president of the Institution of Civil Engineers, Ireland; member of the Institute of Naval Architects; member of the Institute of Mechanical Engineers, and chairman of the Dublin Port and Docks Board.

Company Reports.

Pease & Partners, Limited.—No interim dividend will be paid.

Anderston Foundry Company, Limited.—Interim dividend passed.

Allen Everitt & Sons, Limited.—Interim dividend on ordinary shares, 9d. per share, less tax.

Dennis Bros., Limited.—Final dividend, 4s. per share, making 5s. per share, 25 per cent., for year.

Tube Investments, Limited.—Dividend on ordinary shares for twelve months, 10 per cent. per annum, less tax.

Brown Bayley's Steel Works, Limited.—Half-yearly dividend on preference share capital, making 5 per cent for year 1924.

Nantyglo & Blaina Iron Works Company, Limited.—Dividend £1 per share, less tax, on 8 per cent. preference on account of arrears.

Coventry Chain Company, Limited.—Final dividend on preference shares, 3 per cent., less tax, making 6 per cent. for year; final dividend, 7 per cent., less tax, on old ordinary shares, making 10 per cent. for year; final dividend on new ordinary shares, 5 2-3 per cent., less tax, making 6 2-3 per cent. for year.

New Companies.

Burdett Welding Company, Limited, 35, Walbrook, E.C.4.—Capital £500 in £1 shares. Directors: J. C. Heighway, J. C. Heath and E. S. Hobday.

Fowler and Armitage, Limited.—Capital £5,000 in £1 shares. Engineers and ironfounders at Stocks Lane, Barnsley. Directors: T. M. Fowler, "Cartref," Windmill Road, Wombwell, near Barnsley; J. Armitage, 129, Park Road, Barnsley; and A. Whitaker, 18, Bank Street, Sheffield.

Daniel Owen & Sons (Monton), Limited.—Capital £1,000. To acquire ironfounders' business carried on at Lansdown Road, Monton, Eccles, Lancs. Secretary: Mrs. M. Owen.

Premier Foundry Company, Limited.—Capital £500 in £1 shares. Brass makers. Directors: V. F. Wilkinson, Biddings Lane, Deepfields, near Bilston; F. T. Wilkinson, 99, New Road, Great Bridge, Tipton.

Contracts Open.

Cairo, Egypt, December 1.—Pipes and fittings (Contract No. 5), for the Minister of the Interior, Municipalities and Local Commissions Section, Savoy House, Cairo. The Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. (Ref. A.X. 3,782.)

Chatham, December 6.—595 tons of cast-iron pipes and specials The pipes and specials will be 36 in. 30 in., 24 in., 21 in., 18 in., 9 in. and 7 in., but mostly 36 in. to 18 in. diameter, for the Corporation. Messrs. W. H. Radford & Son, chartered civil engineers, Albion Chambers, King Street, Nottingham. (Fee £3 3s., returnable.)

Sleaford, November 15.—100 lineal yards of iron fencing, for the Rural District Council. Mr. N. D. Preston, highways surveyor, Council Offices, Northgate, Sleaford.

"SERVICE GRC FIRST"

Coal Dispute or no Coal Dispute

WE ARE DETERMINED
TO MAINTAIN SUPPLIES
TO OUR CUSTOMERS

WE CAN DELIVER FROM STOCK

FIREBRICKS,
RED BRICKS,

SILICA, MAGNESITE, CHROME & COROMA
BRICKS & CEMENTS

Ground Ganister, Compo, Cupola Lining Materials, and all our Sands, and sundry Refractory Materials.

We are in a position to supply both Coal Dust and Coke Dust.

We are independent of outside fuel supplies, and can offer both coal and coke to help to keep our customers' works going

The GENERAL REFRACTORIES Co. Ltd., Sheffield

BCM/GRC LONDON.

No need to try and remember our name in case it is unfamiliar to you. This is our British Monomark. Envelopes addressed simply thus will be delivered to us by arrangement with the G.P.O.

THE FOUNDRY TRADES EQUIPMENT & SUPPLIES ASSOCIATION LTD.

IRON AND STEEL MARKETS.

Pig-Iron.

MIDDLESBROUGH.—The continued deadlock in the coal-mining dispute has naturally increased the difficulties of the Cleveland iron position, every day of the prolongation of the strike postponing indefinitely the date when furnaces will again be in full blast and production at normal levels. Until a settlement is finally concluded, there can be little actual business discussed in the Tees-side market, and it is greatly feared by the chief ironmasters that the earliest date now to be hoped for for resuming operations cannot possibly be expected before the end of the current year. Export business has, of course, almost entirely disappeared; the shipments of pig-iron from the Port of Middlesbrough during October have amounted to 3,069 tons—290 tons coastwise and 2,779 tons abroad—as compared with 3,245 tons—300 tons coastwise and 2,945 tons abroad—in September, a decrease of 176 tons. Prices, meantime, continue firm at recent high levels, quotations for Cleveland iron now ruling as follow:—No. 1, 125s.; No. 3 G.M.B., 120s.; No. 4 foundry, 119s.; and No. 4 forge, 118s. 6d. per ton.

The hematite section is also in a state of depletion of stocks, while the price of East Coast mixed numbers remains nominal at about 92s. 6d. per ton, with West Coast conditions similar in stringency of supplies, and prices unchanged.

LANCASHIRE.—In this once active centre of the foundry and kindred iron-consuming industries markets for raw material are practically lifeless, the only business offering consisting of a little Middlesbrough and Scottish No. 3 iron at 137s. 6d. to 140s. per ton, delivered Manchester, and odd lots of miscellaneous East Coast hematite at round 120s. per ton, delivered, being about all that has been available.

THE MIDLANDS.—Foundrymen in this district are experiencing increasing difficulty in obtaining the necessary raw material, the only supplies on offer being some small parcels of Cleveland No. 3, at second hand, for such prohibitive terms as £6 15s. 6d. per ton, delivered prompt, and some Scotch No. 4 at £6 5s. to £6 10s., also delivered.

SCOTLAND.—Throughout this area the difficulty of finding iron to fill the orders which come into the market is daily becoming worse. No. 1 foundry is unobtainable and No. 3 stocks are now almost exhausted also. For any iron which is available the holders are asking about 120s. per ton at furnaces.

Scrap.

Business generally in the scrap metal markets is quiet, but in Scotland demand for heavy machinery cast-iron scrap is still active; as a matter of fact, some people are finding difficulty in obtaining adequate supplies; consequently the price of 82s. 6d. to 85s. per ton for this class of material is being maintained with heavy ordinary cast-iron scrap suitable for foundries about 5s. per ton less. Old cast-iron railway chairs are also strong in demand, and have sold at as high as 82s. 6d. to 83s. 6d. per ton delivered. Light cast-iron scrap has not increased in price.

Metals.

Copper.—A lull in consumptive demand, and reactionary movements consequent upon the after-effects of the formation of the Exporters' Association had an adverse influence on last week's operations in standard copper, the market slowing down considerably at the close, and values suffered a relapse. When the export combine news came to hand recently a lot of buying was effected on American and European account, but the demand since has been distinctly quieter, while near requirements would seem to be fairly well provided, and consumers can thus afford to look on for a while.

Official closing prices of standard copper have been as follow :—

Cash: Thursday, £57 10s. to £57 12s. 6d.; Friday, £57 5s. to £57 7s. 6d.; Monday, £57 2s. 6d. to £57 5s.; Tuesday, £57 12s. 6d. to £57 15s.; Wednesday, £57 15s. to £57 17s. 6d.

Three Months: Thursday, £58 7s. 6d. to £58 10s.; Friday, £58 to £58 2s. 6d.; Monday, £58 to £58 2s. 6d.; Tuesday, £58 10s. to £58 12s. 6d.; Wednesday, £58 12s. 6d. to £58 15s.

Tin.—Disappointment at the disclosure of the figures of the statistical returns for October showing an increase of over 500 tons in visible supplies has had an adverse effect upon standard tin, and the premium on near metal has been very substantially reduced. Fears of some contraction in American industrial activity caused free selling on the short side in face of considerable liquidation, but the market in the lower levels displayed remarkable resistance, as indicated by the ready absorption of all the forward tin coming on offer.

Official closing prices of standard tin have been as under :—

Cash: Thursday, £300 10s. to £300 15s.; Friday, £298 10s. to £299; Monday, £303 to £303 5s.; Tuesday, £309 15s. to £310; Wednesday, £311 10s. to £312.

Three Months: Thursday, £293 10s. to £293 15s.; Friday, £291 5s. to £291 10s.; Monday, £292 15s. to £293 5s.; Tuesday, £297 15s. to £298; Wednesday, £299 15s. to £300.

Spelter.—In this section of the market also dealings have been generally restricted, with prices registering lower levels in the absence of dealers' support. Statistics for October are as follow:—Stocks in Metal Exchange warehouses, 1,136 tons; imports into the U.K. during the month total 10,681 tons; exports during the month total 176 tons; receipts into warehouse during the month, 510 tons; delivered from warehouse during the month, 829 tons.

The following are the week's prices :—

Ordinary: Thursday, £33 6s. 3d.; Friday, £32 18s. 9d.; Monday, £32 17s. 6d.; Tuesday, £33 3s. 9d.; Wednesday, £33 7s. 6d.

Lead.—The market for soft foreign pig during the past week has maintained a steady tendency, despite the weakness in other sections of the non-ferrous metal market. According to the London Metal Exchange, the apparent consumption of imported pig lead in the United Kingdom last month totalled at 24,449 tons, against 17,651 tons in August and 14,927 tons in July.

The week's prices are appended :—

Soft foreign (prompt): Thursday, £29 7s. 6d.; Friday, £29; Monday, £29; Tuesday, £29 5s.; Wednesday, £29 7s. 6d.

Ground Ganister,
Steel Moulders' Composition,
Silica Bricks, Refractory Goods.

PICKFORD, HOLLAND & Co., Ld., SHEFFIELD.

OEHM'S HEATING ELEMENTS

NOT A PENNY ON BUT POUNDS OFF—

YOUR DRYING COSTS.——

Increased drying costs are inevitable to-day, owing to the increased price of fuel, and high prices will continue for some time yet.

In these circumstances it is naturally in your interests to obtain from the fuel you use its full calorific value.

—OEHM'S HEATING ELEMENTS—

will not only do this, but will utilise the heat in the most scientific and economical manner thus reducing your fuel consumption.

Figures have been sent us, the accuracy of which are vouched for by users, that show economies varying from 33 to 75% over their old methods.

—OEHM'S HEATING ELEMENTS—

incorporated with your drying stoves will enable you **to dry to-day at pre-strike costs.**

Write us and let us explain our system and put our propositions before you.

WE CAN SAVE MONEY FOR YOU.

OEHM'S HEATING ELEMENTS

FOR ALL FORMS OF MOULD DRYING, ANNEALING, ETC:

CONSTRUCTED BY

BRITISH DRYING & HEATING CO. Ltd.,
14, WATERLOO PLACE - LONDON - S.W.1.

Telephone: Gerrard 4850. *Telegrams: Britdriet, Piccy, London.*

BRITISH D&H COMPANY LTD

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	57	15	0
Three months	58	12	6
Electrolytic	65	15	0
Tough	63	5	0
Best selected	63	15	0
Sheets	92	0	0
India	73	10	0
Wire bars	66	5	0
Do. November	66	5	0
Do. December	66	5	0
Ingot bars	66	5	0
H.C. wire rods	70	5	0
Off. av. cash, Oct.	58	7	3⅜
Do., 3 mths. Oct.	59	3	10⅜
Do., Sttlmnt. Oct.	58	7	3½
Do., Electro. Oct.	66	10	10
Do., B.S., Oct.	65	4	8⅝
Aver. spot price copper, Oct.	58	7	3
Do., wire bars, Oct.	66	15	8½
Solid drawn tubes			13d.
Brazed tubes			13d.
Wire			9¾d.

BRASS.

Solid drawn tubes	12d.
Brazed tubes	13¾d.
Rods, drawn	11½d.
Rods, extd. or rlld.	7½d.
Sheets to 10 w.g	10⅝d.
Wire	10½d.
Rolled metal	10½d.
Yellow metal rods	7½d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8½d.

TIN.

	£	s.	d.
Standard cash	311	10	0
Three months	299	15	0
English	309	10	0
Bars	309	15	0
Straits	319	0	0
Australian	314	0	0
Eastern	301	5	0
Banca	319	15	0
Off. avr. cash, Oct.	312	14	6⅝
Do., 3 mths., Oct.	303	14	3¾
Do., Sttlmt. Oct.	312	13	9⅝
Aver. spot., Oct.	312	14	6¼

SPELTER.

	£	s.	d.
Ordinary	33	7	6
Remelted	32	15	0
Hard	27	0	0
Electro 99.9	35	15	0
English	33	17	6
India	30	0	0
Zinc dust	43	0	0
Zinc ashes	15	0	0
Off. aver., Oct.	34	4	0⅜
Aver., spot, Oct.	34	5	1½

LEAD.

	£	s.	d.
Soft foreign ppt.	29	7	6
English	30	15	0
Off. average, Oct.	30	15	2½
Average spot, Oct.	30	16	5

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	42	10	0
Do. V.M. ex whf.	39	10	0
Rods	45	0	0
Boiler plates	39	0	0
Battery plates	38	10	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	74	10	0
Chinese	57	0	0
Crude	38	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	16	15	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon —	
25%	£9 2 6
45/50%	£10 17 6
75%	£16 5 0
Ferro-vanadium—	
35/40%	14/- to 14/6 lb. va.
Ferro-molybdenum—	
70/75% c. free	5/3 lb.
Ferro-titanium—	
23/25 % carbon'ess	1 1½d.
Ferro-phosphorus,	20/25%, £17 0 0
Ferro-tungsten—	
80/85%, c.fr.	1/5 lb.
Tungsten metal powder—	
98/99%	1/9 to 1/10 lb.
Ferro-chrome—	
2/4% car.	£33 0 0
4/6% car.	£23 5 0
6/8% car.	£21 15 0
8/10% car.	£20 5 0
Ferro-chrome—	
Max. 2% car.	£37 0 0
Max. 1% car.	£43 5 0
Max. 0.70% car.	£54 0 0
70%, carbonless	1/5 lb.
Nickel—99%, cubes or pellets	£170
Cobalt metal—98/99%	10/- lb.
Aluminium 98/99%	£107 to £112
Metallic Chromium—	
96/98%	3/- lb.
Ferro-manganese (net)—	
76/80%, loose	£15 0 0
76/80%, packed	£16 0 0
76/80%, export	£15 0 0
Metallic manganese—	
94/96%, carbonless	2/- lb.
Per ton unless otherwise stated.	

HIGH-SPEED TOOL STEEL.

	s.	d.
Finished bars, 14% tungsten	2	6
Finished bars, 18% tungsten	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares 3 in. and over	4d. lb.
Rounds and squares under ½ in. to ¼ in.	3d. lb.
Do. under ¼in. to ⅛ in.	1/- lb.
Flats, ½in. × ½in. to under 1 in. × ⅛ in.	3d. lb.
Do. under ½in. × ½in.	1/- lb
Bevels of approved sizes and sections	6d. lb.
Bars cut to length	10% extra
Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£	s.	d.	£	s.	d.
South Wales—						
Hvy. steel	2	12	6 to	3	0	0
Bundled steel & shrngs.	2	5	0 to	2	7	6
Mixed iron & steel	2	7	6 to	2	13	6
Heavy cast iron	2	15	0 to	2	17	6
Good machinery for foundries	3	0	0 to	3	7	6
Cleveland—						
Heavy steel		3	0	0		
Steel turnings		2	0	0		
Cast iron borings		1	17	6		
Heavy forge		4	2	6		
Bushelled scrap		3	10	0		
Cast-iron scrap	3	9	0 to	3	11	6
Lancashire—						
Cast-iron scrap		3	7	6		
Hvy. wrought		3	2	6		
Steel turnings		1	17	6		
London — Merchants' buying prices delivered yard.						
Copper (clean)		48	0	0		
Brass (clean)		37	0	0		
Lead (less usual draft)		26	10	0		
Tea lead		22	0	0		
Zinc		23	0	0		
New aluminium cuttings		82	0	0		
Brazierv copper		44	0	0		
Gunmetal		46	0	0		
Hollow pewter		190	0	0		
Shaped black pewter		140	0	0		

PIG-IRON.

(*f.o.t. unless otherwise stated*).

N.E. Coast –	
Foundry No. 1	125/-
Foundry No. 3	120/-
Foundry No. 4	119/-
Forge No. 4	118/6
Hematite No. 1	93/-
Hematite M/Nos.	92/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	—
„ d/d Birm	—
Midlands—	
Staffs common*	—
„ No. 4 forge	—
„ No. 3 foundry	—
Shrops. basic	—
„ Cold blast, ord.*	—
„ „ roll iron*	—
* d/d Birmingham.	
Northants forge	—
„ fdry No. 3	—
Derbyshire forge	—
„ fdry. No. 3	—
„ basic	—
Scotland—	
Foundry No. 1	—
„ No. 3	117/6
Hem. M/Nos.	—
Sheffield (d/d district)—	
Derby forge	—
„ fdry. No. 3	—
Lincs. forge	—
„ fdry. No. 3	—
E.C. hematite	—
W.C. hematite	—
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
„ fdry. No. 3	—
Northants foundry No. 3	—
Dalzell, No. 3	138/9
Summerlee, No. 3	138/9
Glengarnock, No. 3	—
Gartsherrie, No. 3	138/9
Monkland No 3	138/9
Coltness, No. 3	138/9
Shotts, No. 3	138/9

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom.	11	15	0 to	15	0	0
Angles				12	0	0
Tees to 3 united ins.				12	10	0
Nut and bolt iron				—		
Hoops				14	10	0
Marked bars (Staffs.) f.o.t.				—		
Gas strip				12	10	0
Bolts and nuts ⅜ in. × 4 in.				15	5	0
Steel—						
Ship plates				8	12	6
Boiler plts.				11	5	0
Chequer plts.				9	15	0
Angles				7	12	6
Tees				8	12	6
Joists				7	12	6
Rounds and Squares 3 in. to 5½ ins.				8	10	0
Rounds under 3 in. to ⅜ in. (Untested)	9	0	0 to	11	0	0
Flats, over 5 in. wide and up				9	10	0
Flats, 5in. to 1½in.				8	10	0
Rails, heavy				8	10	0
Fishplates				12	10	0
Hoops (Staffs.)				10	10	0
Black sheets, 24g.				12	2	6
Galv. cor. sheets, 24g.				17	10	0
Galv. fencing wire 8g. plain				12	10	0
Billets, soft				7	15	0
Billets, hard				8	2	6
Sheet bars				7	10	0
Tin bars d/d				7	10	0

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	3
Sheet to 10 w.g.	1	3½
Wire	1	4
Rods	1	3
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free

10% phos. cop. £40 above B.S.

15% phos. cop. £50 above B.S.

Phosphor tin (5%) £30 above price of English ingots.

C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	21.76
No. 2 foundry, Valley	20.26
No. 2 foundry, Birm.	20.00
Basic	19.76
Bessemer	21.26
Malleable	20.26
Grey forge	19.76
Ferro-mang. 80% d/d	88.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	35.00
O.-h. billets	35.00
O.-h. sheet bars	36.00
Wire rods	45.00
	Cents.
Iron bars, Phila.	2.22
Steel bars	2.00
Tank plates	1.90
Beams, etc.	2.00
Skelp, grooved steel	1.90
Skelp, sheared steel	1.90
Steel hoops	2.50
Sheets, black, No. 24	3.00
Sheets, galv., No. 24	3.85
Sheets, blue an'l'd, 9 & 10	2.30
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv.	3.35
Tinplate, 100 lb box	$5.50

COKE (at ovens).

Welsh foundry	—
„ furnace	—
Durham & North.	
„ foundry	—
„ furnace	62/6
Other Districts, foundry	—
„ „ furnace (basis)	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20 × 14, box	24/-
„	28 × 20, „	48/-
„	20 × 10, „	—
„	18¾ × 14, „	—
C.W.	20 × 14, „	—
„	28 × 20, „	—
„	20 × 10, „	—
„	18¾ × 14, „	—

Terneplates 28 × 20, — per box basis f.o.b.

SWEDISH IRON.

Bars, hammered	£18/10 to £19/0
Rolled Ord.	£15/10/0 to £16
Nail rods	£16 5 0 to £16 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£9 to £12
Pig-iron	£6 0 0 to £6 10 0

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes	*Fittings*
Gas	60%	50%
Water	55%	45%
Steam	50%	40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.		
Nov. 4	57	10	0	dec.	6/3
,, 5	57	5	0	,,	5/-
,, 8	57	2	6	,,	2/6
,, 9	57	12	6	inc.	10/-
,, 10	57	15	0	,,	2/6

Electrolytic Copper.

	£	s.	d.		
Nov. 4	66	10	0	No change	
,, 5	65	15	0	dec.	15/-
,, 8	65	15	0	No change	
,, 9	65	15	0	,,	,,
,, 10	65	15	0	,,	,,

Standard Tin (Cash).

	£	s.	d.		
Nov. 4	300	10	0	inc.	10/-
,, 5	298	10	0	dec.	40/-
,, 8	303	0	0	inc.	90/-
,, 9	309	15	0	,,	135/-
,, 10	311	10	0	,,	35/-

Tin (English ingots).

	£	s.	d.		
Nov. 4	298	10	0	inc.	10/-
,, 5	296	10	0	dec.	40/-
,, 8	301	0	0	inc.	90/-
,, 9	307	15	0	,,	135/-
,, 10	309	10	0	,,	35/-

Zinc Sheets (English).

	£	s.	d.		
Nov. 4	42	10	0	No change	
,, 5	42	10	0	,,	,,
,, 8	42	10	0	,,	,,
,, 9	42	10	0	,,	,,
,, 10	42	10	0	,,	,,

Spelter (ordinary).

	£	s.	d.		
Nov. 4	33	6	3	dec.	3/9
,, 5	32	18	9	,,	7/6
,, 8	32	17	6	,,	1/3
,, 9	33	3	9	inc.	6/3
,, 10	33	7	6	,,	3/9

Lead (English).

	£	s.	d.		
Nov. 4	31	0	0	No change	
,, 5	30	10	0	dec.	10/-
,, 8	30	10	0	No change	
,, 9	30	10	0	,,	,,
,, 10	30	15	0	inc.	5/-

AVERAGE MONTHLY PRICES OF STEEL SHIP PLATES IN ENGLAND.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	5 0 0	5 0 0	5 2 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 2 6	5 10 0	5 10 0	5 2 6
1897	5 10 0	5 10 0	5 10 0	5 7 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 7 6	5 10 0	5 5 5
1898	5 10 0	5 8 9	5 8 9	5 10 0	5 16 3	5 18 9	5 17 6	6 0 0	6 2 6	6 5 0	6 10 0	6 15 0	5 18 6½
1899	6 15 0	7 0 0	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 12 6	7 12 6	7 12 6	7 12 6	8 0 0	7 6 5½
1900	8 0 0	8 0 0	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 0 0	8 0 0	8 0 0	7 10 0	7 0 0	8 0 0
1901	6 15 0	6 15 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 5 0	6 7 6	6 5 0	6 0 0	6 0 0	6 4 4
1902	5 17 6	5 12 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 14 7½
1903	5 10 0	5 10 0	5 15 0	6 0 0	6 0 0	6 0 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 10 0	5 13 11
1904	5 7 6	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 11 10
1905	5 15 0	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	6 0 0	6 10 0	7 0 0	7 0 0	6 2 3½
1906	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 10 0	7 0 10½
1907	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 8 4
1908	6 10 0	6 10 0	6 10 0	6 5 0	6 5 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 3 9
1909	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 0 0	6 0 0	5 18 9
1910	6 5 0	6 5 0	6 7 6	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 2
1911	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 18 4	6 15 3½
1912	7 3 9	7 5 0	7 5 0	7 12 6	7 15 0	7 15 0	7 15 0	8 0 0	8 0 0	8 0 0	8 2 0	8 5 0	7 14 10
1913	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	7 19 0	7 15 0	7 3 0	6 15 0	6 10 0	7 16 5½
1914	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 0 0	6 0 0	7 0 0	7 5 0	7 5 0	7 6 3	7 10 0	6 14 8½
1915	8 0 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 5 0	11 0 0	9 12 11
1916	11 7 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 9 2
1917	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1918	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1919	11 10 0	14 0 0	14 0 0	14 0 0	17 0 0	17 7 6	17 15 0	18 5 0	18 5 0	18 5 0	19 12 6	21 5 0	16 15 5
1920	22 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	24 0 0	24 10 0	24 5 0	24 5 0	23 13 4
1921	23 5 0	22 10 0	20 4 0	19 0 0	19 0 0	17 0 0	15 0 0	14 15 0	13 12 0	12 5 0	10 10 0	10 10 0	16 9 3
1922	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 0	10 0 0	9 7 6	9 4 0	9 5 0	9 5 0	9 5 0	9 18 4½
1923	9 7 6	9 15 0	10 5 0	10 10 0	10 10 0	10 10 0	9 18 9	9 17 6	9 17 6	9 17 6	9 18 6	10 6 10½	10 1 2½
1924	10 1 6	9 18 1½	9 17 6	9 17 6	9 17 6	9 19 4½	10 5 0	10 5 0	9 19 0	9 15 0	9 15 0	9 15 0	9 19 7½
1925	9 14 0	9 10 0	9 10 0	9 1 3	9 0 0	9 0 0	8 17 0	8 13 1½	8 7 6	8 5 6	7 16 3	7 14 3	8 15 8½
1926	7 12 2½	7 12 6	7 12 6	7 14 4½	7 15 0	7 16 10½	8 2 6	8 2 6	8 4 0	8 12 6	—	—	7 18 6

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